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FREEDOM OF DEBATE

A DISQUIETING feature of the intellectual atmosphere in the fuel industries of our times is the reluctance, to put it mildly, of technologists of all varieties to debate in their professional associations one of the most important questions of the day—that of a national fuel policy, whether such a policy is urgent or desirable, what form it should take. And there is no disguising the reason for this reticence. Most fuel technologists are now employees of one or other of the nationalised industries, coal, electricity, or gas. They say they wish to avoid this topic because it is inevitably mixed up with politics. It is useless to protest that there is no right and left wing in thermal efficiency, no Conservative or Liberal heat. One suspects, however, that the real reason for this reluctance to speak is more sinister. It is known that in some regions officers of the councils or boards are required to submit their public utterances, even when these are purely scientific in subject-matter, to the approval of public relations officers or some such officials. And even when this is not definitely the case, technicians fear that their chances of promotion may be jeopardised by any public candid expressions of opinion which may run counter to the ideas of the ruling body under which they serve.

It is easy to see that these are no idle fears. What, for example, would be the position of an electrical engineer who should, from a purely technological and objective chain of reasoning, come to the conclusion that the cultivation of the space heating load by the B.E.A. is a mistake, that the official argument that such a load is good for the load factor is illusory? What would be that of a National Coal Board official who should adversely criticise the Board's mechanisation policy or its support of raw coal for room heating? Or of a gas engineer who should venture to advocate the production by his industry of a low temperature coke on a big scale? And it is not very certain that any one of the three major fuel industries is really in favour of a thoroughgoing co-ordination of their activities in the public interest.

It may be objected, of course, that it would be improper for the servant to criticise the policy of his employer. But the fact is that in the first place the technician is the only man who can appreciate the technical aspects of the problem and in the second place this problem should be approached, somewhere, from the point of view of the scientifically ascertained fact and from that of what is technically possible, quite apart from the influence of financial and political interests. The hope that the main aspects of a fuel policy could be worked out by generally well-informed persons without special interests or knowledge was dashed by the Ridley Report. This report not only failed to exhibit any sense of urgency but it left the disappointing impression that the Committee lost itself in a maze of detail through which it failed to see its way.

The Ridley Committee was not greatly helped by the character of the evidence submitted to it by the governing bodies of the several nationalised industries. One can agree that the N.C.B. made some effort to show the problem as a whole. The others dissipated their opportunity to a more or less extent in mutual recrimination of self justification. All that was probably inevitable in view of the financial and other interests involved. The result leaves room for discussion by bodies of professional men accustomed to and brought up in the scientific attitude so that the problem, how to make the best of our dwindling resources of fossilised fuel, can be approached and handled as a matter of science and technology. The solutions ascertained and offered can then be examined to see in what order they can be applied in the sociological field, in the texture of national life as it is.

As we said on our comments on the Ridley Report when it appeared, the ultimate responsibility for a national fuel policy rests upon the Minister of Fuel and Power with the approval of the Cabinet and Government of the day just as much as naval and military policies rest upon their appropriate Ministers. But the Minister will be wise if he arms himself with the free

and unfettered critical opinions of those who have specialised knowledge of the science and technology of fuel expressed in open discussion in their several professional associations.

LITTLE ACORNS

ALTHOUGH the output of the Bridgend undertaking is comparatively small—about 200 mill. cu. ft. per annum—it is nevertheless larger than any other undertaking in the Mid-Glamorgan Group. And it has another claim to importance—a transition during the past decade from the characteristics of a market town to those of an industrial. A general picture of that development is given in Mr. W. E. Whitney's paper to the Wales and Monmouthshire Junior Gas Association, published on p. 396. Such papers describing the growth of a smallish undertaking are of particular interest because the picture is a simple one and easier to grasp than those dealing with a large and complex undertaking.

The main reasons for this growth can be quickly listed. The installation of a large Royal Ordnance factory during the war years, which subsequently became a trading estate with 1 mill. sq. ft. of factory space, brought workpeople to the town and increased the 1939 population of 11,000 to the present-day figure of 14,000. [This trading estate at present consumes 80 mill. cu. ft. per annum.] A large mental hospital which formerly operated its own gasworks and produced 7 mill. cu. ft. per annum now takes 10 mill. cu. ft. direct from the bulk supply main. New houses—400 in one area—brought additional demands for gas.

Gas consumers in the domestic field total 3,000 and it is interesting to note that of these 2,800 have prepayment meters. Average consumption per consumer is 95 therms per annum, but this is considered unsatisfactory and efforts are being made to improve matters. Bread baking, central heating installations, and overhead heaters in installations ranging from a single unit to 40 units complete the picture. In common with many undertakings in Wales, the generally felt difficulties of selling such as hire purchase restrictions, higher gas prices, the ban on promotional publicity, and the decline in spending power are further aggravated by the availability of inexpensive coal.

It is much to the undertaking's credit that all houses in the main area of new development are equipped with points for cooker, boiler, poker, and two gas fires. These are installed at the expense of the council on the Board's standard terms. The appliances are purchased by the tenants, and points exist for fitting electric appliances. In this connection it is interesting to note, in the discussion which followed the presentation of the paper, the satisfaction of the Surveyor of the Bridgend U.D.C. at the desire expressed by council tenants to have gas in all-electric houses because ' the cost of repairs to the electric appliances was a very serious matter for the council.'

We have had a number of papers of this type in recent years, describing the development of various undertakings in Wales. They represent perhaps the most interesting of the changes now taking place in the industry, for since nationalisation no area has undergone greater changes than that of the Wales Gas Board. To those concerned with large undertakings these developments may appear to be of minor importance. But they must be regarded in their proper perspective, and in that light the growth of some of these small works is quite remarkable. Bridgend itself more than trebled its sales of gas between 1938 and 1951.

THE GAS METER TODAY

OVER THE PAST FEW YEARS a most helpful service has been given by Mr. Stanley Armitage, of Parkinson and Cowan (Gas Meters), Ltd., through the series of papers he has presented to gas associations on the working, design, and treatment of the gas meter. He has focused attention on this most important link in the chain of gas service and has freely given to the gas industry the benefit of his experience and intimate contact with the problems and issues involved. In small compass the gas meter is called upon to carry out faithfully, reliably, and without respite an astonishing amount of work. It is, of course, designed and manufactured with this end in view and every meter is by statute tested and proved before being installed. It is, in fact, a precision instrument and should be treated as such, care being exercised in its handling, transport, and fixing. After the meter has been verified these items are the responsibility of the gas undertaking, which responsibility devolves upon the staff employed. With new techniques of gas-making—the supply of butane/air may be cited as example—problems are automatically imposed upon the meter manufacturers. Their response is always excellent and their co-operation is, of course, invaluable. In a paper published on later pages Mr. Armitage offers much of interest concerning gas meter design and performance, and his comments on ' open top ' design, registration, speed, and diaphragm dressings will be studied with profit.

IRONFOUNDERS EXTRAORDINARY

WITHOUT ANY BREAK IN PRODUCTION the Coalbrookdale Company have carried on their business as ironfounders for two and a half centuries. Today it is a constituent member of Allied Ironfounders, Ltd., whose Assistant Managing Director, Mr. W. T. Wren, was responsible for the inception of a recently published history of the Coalbrookdale Company entitled *Dynasty of Ironfounders*. The author, Dr. Arthur Raistrick, did not have an enviable job, but partly because of the comprehensive material placed at his disposal, and partly because of his obvious interest in the growth of the company and the people who built it, he has produced a volume which gives perhaps a unique insight into an important part of the industrial revolution and its aftermath. The ironworks founded by Abraham Darby in 1699 were managed until 1851 by five generations of his family. In that century and a half, the smelting of iron with coke, the development of the steam engine with cast iron cylinders, the introduction of cast iron railways, the building of the world's first cast iron bridge and first locomotive were all achievements realised, at least in part, through the Coalbrookdale Company. The book, which is based on hitherto unpublished manuscript material, including account books, letters, reports, journals, and minute books, shows that the Darbys were Quakers and so knew the Lloyds, Barclays, Gurneys,

Frys, and Goldreys—all families engaged in trade and in social welfare work. Ample information is given not only of the progress of the family, thus embracing a fascinating insight into the social customs and values of the times, but also of prices and marketing methods, a most valuable record for the economic historian. Some of the human touches are quite enlightening. For example, a list of expenses incurred at the funeral of the unfortunate Hannah Darby include such melancholy items as: 'Thomas Corser for shroud and sheet, £1 10s.; Samuel Bowdler for biscuits, £2 10s.; Widow Clarke for wine, £3 14s. 6d.; John Bayley for gloves, etc., £8 18s.; John Fosbrook for a coffin 15s., for a drink 12s., for ye grave 1s.; sundry women in attendance, 13s.; and Dr. Wykes bill, £1 4s. 4d.' The book is produced with an attention to appearance which is all too rare these days, particularly in books of this nature. The publishers, Longmans, Green & Co., are to be complimented, and we have no hesitation in recommending the volume to those of our readers interested in the historical beginnings of this great industry. The price is 30s. net.

INSTITUTION OF GAS ENGINEERS

Her Majesty The Queen has been graciously pleased to grant Her Royal Patronage to the Institution of Gas Engineers. The Institution was recently honoured by the consent of His Royal Highness The Duke of Edinburgh to become an Honorary Life Member.

Personal

Mr. H. V. Pumfrey has just retired after 32 years service with Esso Petroleum Co., Ltd. For many years past he has been concerned with the company's gas oil business, and in this way has come to be widely known in the gas industry. On his retirement, a presentation was made to Mr. Pumfrey by his colleagues.

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Mr. Alexander Jamieson, previously Manager, Greenock Group, has been appointed Manager of the Western Group of the Scottish Gas Board. This appointment is consequent on the Board's decision to amalgamate the Renfrewshire Group of gas undertakings, whose headquarters were at Paisley, with the Greenock Group as from February 1. The new Group, the Western Group, will have its headquarters at Inchgreen Gasworks, Greenock.

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The Chairman of the Gas Council, Colonel Sir Harold Smith, K.B.E., D.L., after he had received the Accolade from Her Majesty The Queen at Buckingham Palace on February 10. On his right is Lady Smith and on his left are his daughters Patricia and Diana.

Mr. W. D. King, a Director of Radiation Ltd., has been appointed Deputy Chairman and Technical Director. Mr. King is succeeded as Managing Director of Richmonds Gas Stove Co., Ltd., by **Mr. H. Sherburn.**

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Mr. F. G. Laming, M.S.E., ASSOC.INST.GAS E. (Distributing Engineers' Department, South Eastern Gas Board) has been awarded by the Society of Engineers the Clarke Premium for 1952 for his paper entitled 'Laying Gas Mains,' read before the Informal Section of the Society on January 25, 1952.

Obituary

D. M. HENSHAW

Huddersfield Parish Church was filled at 10.30 a.m. last Wednesday by those who came from all quarters to pay their tribute of respect and affection to **Daniel Mayon Henshaw.** A short but impressive service was conducted by the Vicar, and this was followed by private cremation. The Turnbridge Ironworks was closed for the morning, and six of the many employees of Messrs. Holmes who were at the church acted as bearers. Mrs. Henshaw was present and her three sons and daughter were among the family mourners.

Directors of the firm present were Messrs. F. Brian Holmes, C. Cooper, S. G. Watson, H. Whiteley, P. Rushworth and G. Chambers. From associated companies Mr. R. H. Redfern (Bryan Donkin) and Mr. F. H. Wilkinson (Waller's) were among the representatives.

Mr. J. T. Haynes, Senior Vice-President, represented the Institution of Gas Engineers; Mr. W. H. G. Roach, M.B.E., the Society of British Gas Industries, of which he is Vice-Chairman; and Mr. F. M. Birks, C.B.E., the Gas Gallery Committee, on which he has been so closely associated with Mr. Henshaw. Among those from our great engineering firms were Messrs. Charles Dempster, B. C. Morton, R. M. Goodman, K. W. Francombe and T. Heslop. Among many from the Gas Boards and undertakings were Mr. J. G. Tilley, General Manager of the Huddersfield-Halifax Group, and Mr. H. Singleton, of Huddersfield. From further afield came Messrs. C. H. Pearson and George P. Mitchell.

The gathering in the Parish Church last week was truly representative of a vast family of men and women in all walks of life who know the world is poorer by the death of Dan Henshaw. In over thirty years gas industry association I have not met a man more admired and beloved for understanding, kindliness, charm, and strength withal. I do not believe he ever thought ill of anybody, save a villain. A year ago I watched him make his way through the dining room of the George Hotel. It was not his recent infirmity, so stoically carried, that made a slow and regal progress of that walk, but the fact that table after table of diners rose to pay their respects to a friend and leading citizen. "He was always so good to the young men"—such was the memory, voiced by one, that brought many to join that gathering in Huddersfield. From them and the hundreds they represent go sympathy and understanding to family and firm.

C. A. K.

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Mr. H. J. TOOGOOD writes:

The suddenness of the passing of Mr. D. M. Henshaw is a shock to his many friends. His was a lovable personality. My loss is especially sad, because we were both natives of Bristol, both trained at the Merchant Venturers'. After some years, both found anchorage in gas engineering firms in Yorkshire and within a few miles of one another. A warm friendship resulted which I shall sorely miss. Mr. Henshaw had that rare ability to find true happiness in his work.

Because of the drain on house coal caused by the cold weather the amount of coke which householders may buy before May 1 is to be increased by one ton. This was announced in the House of Commons on Monday by Mr. Geoffrey Lloyd, Minister of Fuel and Power.

Diary

Feb. 19.—Midland Juniors: Half-day Visit to Joseph Lucas (Electrical), Ltd., Birmingham.

Feb. 19.—Eastern Section, I.G.E.: Short Paper Day: 'Automatic C.V. Control,' K. R. Mortimer. 'The Trend of Gas Consumption and its Effect on the Future,' A. Collinson. 17, Grosvenor Crescent, London, 2.30 p.m.

Feb. 20.—London Juniors: 'Plastics,' J. M. J. Estevez, 6.30 p.m.

Feb. 20.—Wales Gas Consultative Council: City Hall, Cardiff, 11 a.m.

Feb. 21.—Yorkshire Juniors: 'Spectroscopy in the Gas Industry,' P. Egan, Harrogate.

Feb. 25.—Scottish (Western) Juniors: Evening Visit: Glenpatrick Carpet Factory, Johnstone.

Feb. 25.—Western Juniors: Visit to Works of Lysaghts, Ltd., Bristol.

Feb. 26.—North Thames G.C.C.: Caxton Hall, Westminster, 2.30 p.m.

Feb. 26.—Midland Section, I.G.E.: Joint Meeting with Institute of Sewage Purification; 'Further Experimental Work on Gasworks Liquor Treatment,' A. J. Clifford and J. T. Rees; Birmingham Chamber of Commerce, 2.30 p.m.

Feb. 28.—Manchester Juniors: Annual Dinner, Lyme Park, Disley, Cheshire.

Mar. 3.—East Midlands G.C.C.: Leicester and County Chamber of Commerce, Granby Street, Leicester, 11.30 a.m.

March 3-28.—Ideal Home Exhibition, Olympia. Gas Council stand No. 70, Grand Hall, ground floor.

March 3.—South Eastern Gas Consultative Council: Meeting, 4, Wandsworth Road, S.W.8, 2.15 p.m.

March 7.—Scottish (Eastern) Juniors: Joint meeting at Glasgow. Paper by W. K. Tate, Junior Vice-President, Institution of Gas Engineers.

March 11-12.—Gas Sales and Service Conference, Seymour Hall. (For full programme see *Journal*, January 14, p. 91.)

March 13.—London Juniors: Lecture Theatre, North Thames Gas Board's Offices, 178/180, Edgware Road, W.2, 6.30 p.m.; 'Southampton's Gas Distribution System,' R. K. Harrison.

March 16.—Eastern G.C.C.: Connaught Rooms, Kingsway, W.C.2, 2 p.m.

March 17.—London Section, I.G.E.: 'Firing of Pottery Kilns by Gas,' A. F. Searle.

March 17.—Midland Juniors: Staff Mess Room, West Midland Gas Board, Council House, Birmingham. '25 Years' Experience on a Chemical Works,' H. Alridge, Birmingham.

March 18.—Eastern Juniors: Stamford; Visit to the Works of Williamson Cliff Refractory Co., Ltd.

March 18.—South Western Section, I.G.E.: Cheltenham. 'Integration and the Scope for Development,' T. W. Jackson; 'Some Aspects of Works Management,' T. N. Dent.

March 18.—Manchester Juniors: Visit to Davyhulme (Manchester) Sewage Works, by invitation of Manchester Corporation Rivers Department. 'Treatment of Industrial Effluent.'

Gas in Industry

THE South Western Gas Board preceded the opening of their exhibition at Bristol (last week's *Journal*, p. 330) with a visit to the site of the new Stapleton Road Works, where work has been seriously delayed by shortage of steel. Luncheon followed, and Mr. T. MERVYN JONES proposed the toast of 'The City and County of Bristol.' Sir Harold Smith, he said, would have made the speech, but was that very morning receiving his accolade of knighthood from Her Majesty the Queen. The speaker continued by commenting on the ties between the boards across the Bristol Channel. Land, sea, and air all played their parts. The Stapleton Road Works will produce 21.5 mill. therms of gas and 116,000 tons of coke every year from 270,000 tons of coal, which in comparison with the citizens burning that coal themselves, meant a saving of 45,000 tons a year. He then mentioned the spirit of the Merchant Venturer and Bristol, and the gas industry's need to maintain this spirit.

The SHERIFF OF BRISTOL (Mr. S. W. Cornwell) responded, and drew attention to the great problems of the Board in supplying gas through ten counties and to over three million people.

Mr. C. H. Chester, O.B.E., Chairman of the South Western Gas Board, in proposing the toast of 'The Guests,' made further references to the efficiencies of the Stapleton Road Works and the effect on the price per therm due to increased technical efficiency. The Hon. L. W. JOYNSON-HICKS, M.P. (Parliamentary Secretary to the Ministry of Fuel and Power), in his reply, paid tribute to the consultative councils and district committees.

After the luncheon, the Parliamentary Secretary declared the exhibition open.

Banff Works in Production Again

WITH BANFF GASWORKS in production to the extent of 250,000 cu.ft. daily, Mr. A. W. Brown, Deputy Controller of the Northern Division of the Scottish Gas Board, who supervised the reconstruction work following the devastation of the great gale, returned to Aberdeen on February 12. With him were Mr. W. M. Johnston, chief engineering assistant, who carried out the remarkably quick planning job necessary, Mr. W. D. Millar, technical assistant, and Mr. James G. Scott, production assistant.

Plant to the value of over £5,000 was installed under atrocious working conditions within a week, and everywhere in Banff, Macduff and Whitehills there has been high praise for the expeditious manner in which the supply of gas was restored.

Mr. E. E. Pitt, district manager, said that but for the help he received from Chief Constable Strath and his staff, and Mr. J. E. Stewart, head postmaster, the progress made would not have been possible. There are now erected, as permanent plant, exhausters, condensers, tar washers, ammonia scrubbers and a new mains system from the works to the new plant, which stands outside the main buildings. Still to be overtaken is the rebuilding of the sea wall, which was washed away together with the original plant. This work will cost in the vicinity of £3,000.

Our Attention has been called to the omission of the name of Mr. Anthony Sugg in the list of Directors of William Sugg & Co., Ltd., given on p. 43 of the *Journal* of January 7.

Visit to George Wilson's

On February 10, George Wilson Gas Meters, Ltd., entertained at their Coventry works some 52 members of the Women's Gas Federation (Coventry Branch), who were given an insight into the assembly and testing of meters. Great interest was shown by all the visitors in the various stages of gas meter production, and the great care that has to be given to every detail in order that the consumer has a satisfactory appliance when fitted in the house. Some surprise was expressed at the number of tests that are necessary to ensure trouble-free appliances and the safety of the householder.

The tour of the works took approximately two hours, after which the party adjourned to the works canteen for tea, where they were welcomed by Mr. G. E. Withers, Director and Secretary of the Company, who gave a brief outline of the history and growth of the firm over the past 50 years.

Thanks were then tendered on behalf of the Women's Gas Federation by Mrs. A. E. West (Chairman).

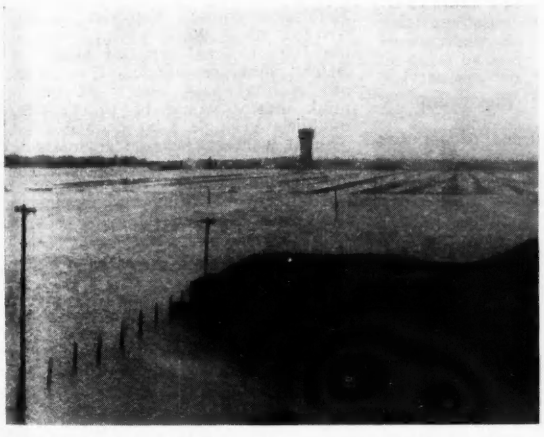
Mr. F. C. Wilson, Director, replied, and expressed the hope that further visits would be arranged in view of the great interest that had been taken by all members of the Federation.

The Use of Welding in steel building structures is the subject of Technical Brochure No. 6, published by the British Constructional Steelwork Association, Artillery House, S.W.1. The object of the publication is to give guidance on the design of metal arc welded steel building structures under nominally static loading conditions, made in mild and high tensile steels and designed as simple frames.

GRAPHIC PICTURES of the MABLETHORPE FLOOD DISASTER

FROM THE HOLDER.—Mr. L. B. Chapman, Skegness Group Manager, with Mr. Smalley, Distribution Superintendent, surveying the scene of devastation.

THE MEN ON THE SPOT.—Discussing emergency arrangements are (seated) Mr. F. Beaumont, Local Manager, and (standing), left to right, Mr. J. Horton, Accounting Officer, Mr. D. W. Ault, Lincolnshire Divisional Engineer, and Mr. J. W. Wilson, Divisional Distribution Engineer.



WATER EVERYWHERE.—The expanse of flood water as seen from the gasworks. In the foreground is the coke heap.

THE HIGH STREET.—Several feet of flood water covered Mablethorpe High Street. This view was taken from the gasworks

AFTERMATH.—Fitters removing a meter from a house which had been flooded, after plugging off the gas service. The photo shows the enormous quantity of silt left behind by the flood water.

SHOWROOM SCENE.—The view that met the manager's eyes when he entered the showroom. The height reached by the water can be clearly seen on the appliance in the foreground and on the wall behind.

Negotiation and Joint Consultation

ON February 9 the Institute of Public Administration devoted one of its series of meetings on negotiation and joint consultation in the public services to the gas industry. The chair was taken by Mr. E. R. VOSE, Head of the Organisation Branch of the National Coal Board.

Dr. A. B. BADGER, Industrial Relations Officer to the Gas Council, described the negotiating and consultative machinery in the industry. It could not be understood, he said, unless they considered the history of this type of machinery from its inception. Before 1918 there was no national machinery except for publicity, but in that year the National Gas Council was established to deal with parliamentary and legal questions and labour matters.

In 1916 the Whitley Committee was set up, and its report two years later recommended the creation in every industry of an organisation representative of employers and workpeople to consider matters affecting the progress and well-being of the trade and to apply themselves to promoting industrial harmony and efficiency. As early as 1919 an organisation covering manual workers in the gas industry had been agreed to, so that gas was one of the first industries to implement the Whitley recommendations.

Negotiating machinery for administrative and clerical workers did not come up for consideration till 1943, and in 1947 national and regional joint councils for gas staffs were established Machinery was later created to cover the craftsmen within the scope of the Confederation of Shipbuilding and Engineering Unions, and from 1946 joint negotiation was established for building workers employed in the gas industry.

An Obligation

The Gas Act of 1948 placed an obligation on the Gas Council and the area boards to reach agreements with the appropriate organisations of workpeople for the establishment of machinery for the settlement by negotiation of conditions of employment and 'for the promotion and encouragement of measures affecting the safety, health, and welfare of persons employed by the board or council, and discussions on such matters of mutual interest . . . including efficiency in the operation of the services . . .'

The machinery set up at vesting date differed only in name from what had been in operation before, for it had been working smoothly: the industry had had since 1918 a proud record of happy relations with organised labour. It was, however, supplemented by machinery to deal with grades of employees who could not be defined as manual workers nor as staff and who were known as intermediate grades. Similarly, in 1951, a constitution was laid down for a Senior Gas Officers Joint Council to cover employees whose salaries were above those negotiated through the Joint Council for Gas Staffs.

Dr. Badger went on to describe the constitutions and functions of the various bodies. The National Joint Industrial Council consists of not more than 30 members appointed as to one half by the Gas Council and as to the other half by the trade unions concerned. The functions are those defined in section 57 of the Gas Act outlined above. Each area board has set up an area council of the National Joint Industrial Council charged with the duty of implementing the agreements of the national body, considering matters referred to them by that body, making recommendations to the national council, and taking other action on matters of interest in the area subject to the national council's right of veto. The constitution and functions of the joint machinery for gas staffs follow similar lines. At local level, as part of the machinery of joint consultation, joint consultative committees (*i.e.*, works committees) deal with questions of interest at works level, including health, welfare, and safety. They are not empowered, however, to discuss any questions relating to wages, salaries, or conditions of employment.

The Employer's Viewpoint

Dr. Badger then turned to appraise the joint machinery from the employer's point of view. He listed a number of weaknesses. First, he thought the machine was over-centralised. Service conditions formerly were decided by direct personal contact with the employer, but this was no longer possible. No matter how accurate job descriptions might be—and in this country they were notoriously inexact—it was difficult to assume that all shorthand typists, for example, did the same amount and quality of work and carried the same responsibility. But large firms or regional or national agreements must proceed on some such assumption, and there was bound to be some relative inequality of reward for the value of the work performed.

Another weakness was the multiplicity of bodies with which the employer was concerned. He did not advocate the creation of one joint council for all employees, but he thought that at least all manual workers might come together in a single organisation. He thought, moreover, that the fixing of regular meetings of joint councils sometimes led unions to 'scrape the barrel' for something to put on the agenda.

The trade unions, said Dr. Badger, showed no sign of abandoning their traditional militancy towards the employers of nationalised undertakings. He thought that, with the improved service conditions, the lack of profit-making, and the common interest of trade unionists as consumers in the well-being of the industry, they would have adopted a new attitude of co-operation. He objected, too, to the refusal of trade unionists to allow non-members to participate to the full in the benefits they had won, notably in the use of the appeals machinery. And lastly he considered that the unions did not sift adequately the grievances which their members put forward before presenting them to the joint councils for consideration.

Against these weaknesses Dr. Badger put forward a list of virtues of joint consultation which in his view far outweighed the drawbacks. The industry had a proud record of industrial relations. There had been no national strike since 1918 and no resort to arbitration. Those who co-operated in drawing up the agreements were familiar with the conditions in the industry and were accustomed to providing for a measure of elasticity to enable changes to be made to meet changed circumstances. Those who served on joint councils were people with an intimate knowledge of the industry, which would not be the case if the conditions of employment in the industry were decided by wages boards.

Mr. F. HAYDAY, of the National Union of General and Municipal Officers, after congratulating Dr. Badger on his statement of the factual background, supplemented it by remarking that the National Joint Industrial Council covered some 100,000 employees and the Joint Council for Gas Staffs some 30,000; these represented the majority of the total personnel. He did not think that it would be practicable to establish a single joint council for all manual workers, because engineers and building workers were allied to workers outside the industry and were subject to different conditions of employment from those inside.

Criticisms Cancelled Out

Dr. Badger's criticisms were largely cancelled out by his reference to good relations in the industry; this had not grown up since nationalisation but was the result of a painful process of development since 1918. At that time, when the machinery was set up, there had been grave suspicion between the two sides. Nowadays the greatest value of the machinery lay in the feeling of mutual confidence between the two sides: it was a great asset to the industry and had grown up through association in the joint councils. It was not always the formal discussions in the official machinery that were most beneficial, but the informal consultations which led to an appreciation of each other's point of view.

Another principle shared by the two sides was the necessity to uphold the decisions of the joint machinery; neither side was prepared to depart from these decisions to meet some immediate situation.

Discussing Dr. Badger's comment on the centralisation of the joint machinery, Mr. Hayday remarked that this was true of the staffs councils but not of those covering the manual workers. Functions were divided between the national and the area councils, the former deciding matters that could be applied equally to all, such as fixing rates to be applied to 'A' or 'B' areas; the area councils then graded the towns in their areas and dealt with the application of differentials built on top of the national

minima. There were widely different types of plant and the area councils made allowances for these differences in arriving at fair wages and conditions. If such things were decided centrally it would bring about a feeling of remoteness from the men on the spot, who, Mr. Hayday pointed out, were directly represented on area councils.

The joint machinery in the gas industry, Mr. Hayday claimed, worked without delay. It was not unwieldy. It was very rare that a large-scale wage claim would go beyond two meetings of the national council, covering possibly a month or six weeks. Criticism of delays by union members arose, he said, because after every settlement some branches would argue that the award was inadequate and that a higher claim should be made forthwith; this would be set aside by the union until a proper period had elapsed. Then, when a further revision took place, the critical branches would argue that this was the delayed result of their representations.

Dealing with Dr. Badger's objection to the exclusion of non-unionists from the appeals machinery, Mr. Hayday said that the employers and the organised workers had contributed jointly in time, money, and services to the machinery and its results. Why give it freely to those who contributed nothing? He denied that there was ever any need to 'scrape the barrel' to find material for joint meetings. He said that every proposal put forward was carefully examined before submission to the joint machinery and that only one in twenty got on to the agenda at all. There were only four meetings a year and the trade unions had to choose between the items they could put forward and arrange an order of priority.

Works committees, Mr. Hayday went on, had only advisory functions. They had only been going a year. There had been a long difference with the employers about the qualifications of those who were to represent the workers; the unions said they must be members and this had now been accepted.

The value of works committees in theory was very great, but how they would work in fact had yet to be proved. Only a few reports had yet been received. But it was clear in their minds that national and area negotiation would be ineffective unless there was satisfactory machinery at workshop level where they got down to the men themselves. At works level they should be given the same responsibility as at area and national level. There was a genuine desire on the part of the workers to contribute their experience and practice to the efficiency of the undertaking. They did not want the management in the industry to resent honest criticism from their subordinates or to feel that they were surrendering any part of their functions; if there was criticism it was better for the man concerned to explain and defend his attitude rather than to go about the works talking behind the manager's back.

Mr. Hayday went on to say that the union members needed to be equipped in order to deal with the complex technical matters which came up in the joint consultative machinery; to this end they were sending their members to technical courses and they appreciated the facilities. In joint consultation the management and the men must work to make it a success and get away from the attitude of opposing sides; they had a joint interest in the success of nationalisation.

Halifax Dispute Settled

A SETTLEMENT has been negotiated in the dispute between Halifax Corporation and the North Eastern Gas Board respecting the £15,000 transferred by the Corporation in March, 1949, from the gas undertaking to the rate fund. The Corporation having paid the Board £7,500, claims and counter-claims will be withdrawn. Mr. E. de Z. Hall, Halifax Town Clerk issued the following Press statement:

'It will be remembered that the North Eastern Gas Board in July, 1951, issued a writ against the Halifax Corporation to recover £15,000 transferred by the Corporation from the gas undertaking in aid of rates. The Minister of Housing and Local Government had in April, 1951, issued a determination that the Board's claim was well founded. The Corporation counter-claimed for the sum of £18,346 in respect of the revenue surplus taken over by the Board on vesting day. In resisting the Board's claim and in making the counter-claim, the Corporation acted on the advice of learned counsel. Early in 1952 the Court of Appeal upheld the defence of a Gas Board to a claim by a former gas undertaking in circumstances somewhat similar to those of the Corporation's counter-claim, while in December, 1952, the Queen's Bench Division found for a Gas Board on a claim precisely similar to the North Eastern Gas Board's claim against the Corporation. In these circumstances the Corporation has negotiated a settlement of the matters now in dispute. Bearing in mind the Corporation has since March, 1949, had the use of this money, it is felt that the settlement is a very reasonable one.'

First Aid Certificates for Gas Council Staff

COLONEL SIR HAROLD C. SMITH, Chairman of the Gas Council, presented on February 3 certificates to members of the staff who recently passed the examination in first aid held by the St. John Ambulance Association.

In presenting the certificates, Sir Harold mentioned that this was the first occasion on which classes in first aid had been held at Gas Industry House and he congratulated the successful candidates on the keenness which they had shown in what was an excellent example of voluntary service to others.

On behalf of the Gas Council he thanked them for the readiness with which they had given up their time for the training, and also expressed the Council's appreciation of the help which Dr. M. M. Scott, Deputy Surgeon in Chief of the St. John Ambulance Brigade, and Mr. C. Stone, of the North Thames Gas Board, had given in the instruction and training.

Members of the staff who have obtained the Certificate are: Miss G. Bundy, Mrs. E. Crossingham, Miss P. Davey, Mrs. M. Davis, Miss D. Gleeson, Mrs. M. Gravett, Miss J. Menheneott, Mrs. J. Parker, Miss A. Resnick, Miss B. Robinson, Miss M. Stent, Miss M. Wiggins, Mr. J. Jones, Mr. T. F. Kerr, Mr. J. Lock, and Mr. A. G. McCormack.

Warning of Price Increase in North East

MEMBERS of the North Eastern Gas Consultative Council at a meeting in Leeds on February 2 were warned by Dr. R. S. Edwards, Chairman of the North Eastern Gas Board, that a further increase in the price of gas may be necessary as a result of recent wage increases and other very heavy additional costs. The Board had been forced to give very careful consideration to the price of gas and he felt he should tell the members that this matter was under review, said Dr. Edwards, and they might have to ask the Chairman to call a special meeting of the Council to consider representations from the Board.

Earlier in the meeting the Council passed a resolution, moved by Alderman H. Sutcliffe, expressing concern at increases in administrative costs, and calling for the Board to review the position with the object of effecting economies. Commenting on the annual Report of the Board, Alderman Sutcliffe said it seemed to him they had reached a point where it was doubtful if the present tariff was going to cover costs. They had some room for misgivings about the increase of operative and administrative staffs which did not seem warranted by the small increases in gas sold. The number of operatives had increased by 206 from 6,848, although he appreciated that many of these were employed on contract maintenance work. The position was still worse on the administrative side, where there had been an increase of nearly 100 staff in the six groups in the area.

The costs of rendering accounts had also shown abnormal increases over the year, and it was no wonder that some of them were a little worried that if this tendency for increases continued, they would soon be faced with an increase in the price of gas once again. Sooner or later, continued Alderman Sutcliffe, the North Eastern Gas Board would have to be competitive, and if these increases continued, more gas consumers might find it necessary to change to alternate fuels.

Dr. Edwards said the question of staffing was constantly under review, but many tasks were now rightly being carried out by the Board employees which in the past had come under the jurisdiction of Ministerial Departments. They had now reached something of a stabilised labour force. The gas industry needed a lot of capital, and the cost of plant had gone up against the Board in a most adverse fashion during the last three-and-a-half years. Increase in the bank rate had doubled interest charges, and these two items alone had added £200,000 a year to the Board's costs. His own feeling was that apart from any expansion of business—and it was disappointingly slow at the moment—they had got somewhere near the peak of their labour force.

More Steel for West Midlands

MR. G. LE B. DIAMOND, Chairman of the West Midlands Gas Board, told the West Midlands Gas Consultative Council at its meeting at Birmingham on February 2 that during the past fortnight the Board had received quite a substantial allocation of steel for the West Midlands—on paper—and they were now trying to place it out to contractors. They had in fact placed a substantial amount but there was a large balance and he had officers in various places endeavouring to get it placed. They would understand that steel was allocated for a certain period of time and if it was not taken up it was 'lost;' hence the importance of geting it placed as quickly as possible.

The Chairman (Alderman W. H. Malcolm) submitted a letter from Mr. F. H. Cureton (Secretary of the Board) reporting on a full investigation into the question of public lighting at Hereford so far as it was the concern of the Gas Board. Only one quarter, approximately, of the 200 gas lamps damaged or knocked down during the war had been replaced. On one estate, where some of the complaints originated there were still approximately 32 lamp standards without lanterns, this being 40% of the total. In other districts there were 70 lamp standards without lanterns.

On the estate referred to, comparisons were naturally made with the full lighting and good spacing of lamps on the estates lit with the new electric lighting. One quarter only of the columns on the pre-war portion of this estate were lit but it was understood the Corporation was taking steps to raise the percentage. These comparisons and the oft-repeated intention of the Corporation to extend street lighting by electricity obviously encouraged residents to press for improvements.

Some 70% of the lamps were over 40 years old and so far the Corporation had been unwilling to authorise their replacement.

The Consultative Council was reminded that the number, spacing, and lighting capacity of street lamps was a matter for determination by the local authority. It had been known for some time, both by the Corporation and the Board, that improvements in these respects were necessary before satisfactory standards could be attained and and the Board would be pleased to submit schemes and to co-operate with the Corporation in any practicable way.

New Tariffs

Another letter from the Board dealt with the new tariffs about which a deputation was received from Lichfield and other authorities at the last meeting. In this it was stated that full consideration had been given to all representations received since the new tariffs were published and in particular the Board had examined very carefully the case submitted in December by the deputation of local authorities to the Consultative Council in respect of the present charges in Cannock, Lichfield, and Tamworth and from certain districts in which the highest prices were charged.

The tariffs had been re-examined in the light of the stated principles, which received the approval of the Consultative Council before they were adopted. As a result the Board confirmed that the principles had been correctly and reasonably applied in each of the districts concerned.

Re-stating in a lengthy memorandum the policy considerations which had to be taken into account when framing the tariffs, the Board stated that its short and longer term policy with respect to gas prices was as follows:

(i) To adhere to the undertaking given when the new tariffs were introduced to review the present charges after a full year's working and to give further consideration to representations made since the publication of the tariffs. To the extent that the circumstances then prevailing permit, tariff adjustments will be discussed with the Consultative Council.

Integration of Supplies

(ii) The integration of supplies from more efficient works to neighbouring undertakings will be pursued vigorously with the intention of passing on consequential benefits to the districts concerned. A word of caution is, however, necessary in that this policy is dependent upon the availability of steel, cast iron pipes and suitable labour for its execution. Plans have been made; in many cases plant is on order and, in some cases, in course of erection. The fulfilment of the plans necessarily turns on factors on which the Board may have but little control.

(iii) Meanwhile, it is not possible to anticipate the findings of the promised review. Further substantial costs have fallen on the Board during the current financial year. Fortunately, with the aid of internal economies and of an unexpectedly large increase in revenue from tar sales (which may not be continued) these increases have been absorbed. While every effort will be made not further to increase prices and indeed, if at all practicable, to reduce some, the position is largely dependent on factors outside the Board's control, such as the maintenance of the increased revenue from tar and of current prices of coal and other materials.

The Council agreed to the findings of the Board being sent to the deputation.

A question having been raised as to termination of a two-part tariff agreement and the fact that no written notice was received it was explained that legal advice was taken and notice given by means of advertisement. Mr. Diamond said they did not just carry out the Gas Act but took advice which was to the effect that what they were doing was right. Three months elapsed between the advertisement and the application of the new tariff.

A letter from a consumer at Newcastle complained that no personal notice was given of the withdrawal of discounts on gas accounts, which it was suggested was a normal commercial practice.

It was pointed out that accounts were payable on demand and should be settled within a reasonable period.

A member asked what was meant by 'on demand' and Mr. Diamond suggested that accounts should be paid within a week or a fortnight, but a member urged that the period should be at least a month. Mr. Diamond added that if people paid promptly it would save the Board a great deal of trouble as well as expense. The Board wanted to be reasonable.

Attention was called to a case involving proceedings, in which a disc was placed in a meter instead of a shilling and Mr. Diamond was asked what was the position if the collector was given the right amount.

Mr. Diamond said the proper thing was for a shilling to be put in the meter and the Board could not take cognisance of any other method. If a disc was put in there was the point that gas had been used and something which was not legal tender had been offered for that gas.

Attention was called to a shortage of shillings in the area and it was suggested there were occasions when for a variety of reasons difficulty in providing the requisite shilling might arise. Several members showed sympathy with the position in which a consumer might sometimes be placed.

Hoarding Shillings?

A question was asked if the Board might not be guilty in having a large number of shillings in its possession but Mr. Diamond retorted that they were in transit and were only in their possession for 'hours.' Another suggestion was that more multi-coin meters should be provided.

Mr. Diamond said it would be a fantastic undertaking to expect a million meters to be replaced. A consumer could not have a new meter just because he wanted it, but in fact where meters were changed because the old one was worn out, or where new meters were installed they were provided with dual coin attachments.

The question of the joint reading of gas and electricity meters was raised and it was stated that an experiment on these lines was to be made in some parts of the country. The results would be watched with interest.

A statement was presented as to the progress of extensions at Walsall. Mr. Diamond said that during the past week they had had a substantial allocation of steel for Walsall which would bring about a big improvement.

Asked what he meant by 'substantial' Mr. Diamond said something in the nature of over 1,000 tons but they had not yet been able to place it.

The work at Walsall will be discussed at the next meeting. Meanwhile the report on progress stated that the former owners, the Walsall Corporation, decided

to reconstruct the gasworks and accepted a tender of the Woodall-Duckham Company in February, 1949, for the erection of new carbonising plant and ancillaries, and this project received the approval of the Town and Country Planning (Development by Local Planning Authorities) Regulations, 1948. The Corporation was informed by the contractors that the estimated completion of the installation would take 5½ years from the date of the receipt of instructions to proceed—*i.e.*, the contractors undertook to have the new plant working late in 1954.

Before vesting day, when the newly appointed West Midlands Board was an organising committee, it was asked to give the Minister its views on the proposed reconstruction of the Walsall works and to state whether it thought it would fit in with plans the new Board might have for the area as a whole. The West Midlands Gas Board reported favourably on the scheme and it received an authorisation from the Minister, under Defence Regulation 56A. Subsequent examination indicated that the extensions proposed by the former owners might, with considerable advantage, be expanded, and the West Midlands Board was able to obtain a partly prefabricated carbonising plant from the Woodall-Duckham Co. which had been placed on order by the Romford Gas Company but was not required by the North Thames Gas Board. In July, 1949, the Woodall-Duckham Company arranged for the steel which had already been manufactured for the Romford plant to be delivered to Walsall for storage pending erection. At no time during these negotiations or since was the original contract delayed or deferred and, up to the end of 1950, it was clearly understood that the Romford plant would be ready by October, 1953, and the original Walsall plant would follow late in 1954.

At this juncture, some delay took place in obtaining planning permission, but this had no effect whatever on the work of the contractors, who should have been preparing the drawings and purchasing the steel. The first intimation the Board had that there was difficulty in obtaining steel for this contract was on April 9, 1951, when the allocation of steel became increasingly stringent. Later on, when steel became really difficult, the discovery was made that only part of the Romford plant had been fabricated and the steel for the remainder had not been ordered.

This matter was taken up strongly with the contractors and also with the Ministry. From January, 1952, onwards, the revised allocation of steel to the gas industry imposed a cut of approximately 50% against its requirements. This had the effect of seriously postponing the completion of the Walsall project, and at the present time no indication could be given when the Walsall plant, or any part of it, would come into production. There were, however, signs that the steel supply position would be easier in the near future and the moment the Board received a substantial increase to the present allocation a suitable allotment would be made to Walsall.

Thank You, Councillor Constable!

THERE is a natural modesty in most of us which shrinks from any suggestion of blowing our own trumpet. On the other hand we have no objection to someone else blowing it for us. It takes a lot to make a hard-boiled newspaper blush, but we must confess that a faint glow suffused our cheeks when we listened to Councillor A. B. Constable's advice to members at the meeting of the South Eastern Gas Consultative Council on February 3.

In winding up the meeting, the Chairman urged members to make themselves more conversant with current activities in the industry by reading the industry's technical Press. There were a number of gas periodicals, he said, 'but I think I get most value from the *Gas Journal*.' Holding up a copy for all to see, he added: 'There is usually more knowledge in it and more information about consultative councils.' He fell slightly from grace when he urged members to *borrow* copies from their local undertakings (as distinct from becoming regular subscribers); but, nevertheless, thank you, Councillor Constable!

The Chairman's remarks followed an expression of appreciation from Mr. E. Wood (Secretary of the Council) to the Press for giving space to their activities—though we thought we detected a partially veiled note of disappointment that still more publicity is not given to the reports of their meetings which go out to some 70 newspapers. The solution lies, of course, with the councils themselves—and here we refer to *all* consultative councils. Just as soon as they make real news they will hit the headlines. Ninety-nine per cent. of their deliberations at the moment fall into the category of 'dog bites man,' which is not news. When they succeed in winning a resounding victory over a gas board in the cause of the consumer the story will then fall into the category of 'man bites dog'—which *is* news.

Central Heating Tariffs

We would like to pick out a point or two from the last meeting of the S.E.G.C.C. for comment. There have been considerable heartburnings among consumers over the very selective application of certain special tariffs. For example, most gas boards have a central heating tariff. But when a consumer chooses to heat his premises by, for example, a gas-fired unit air heater system he finds himself excluded from the benefits of the tariff for no very obvious reason. The argument advanced by gas boards appears to be that since individual sections of a unit air heating system can be turned off at will it is not a genuine central heating system. This argument seems to us to be fallacious inasmuch as any section of a normal central heating system can equally be turned off at will by the simple expedient of by-passing individual radiators or circuits.

On this general question it is not uncommon for gas boards to quote Section 53 (7) of the Gas Act whenever special tariffs are called into question. This clause in fact lays down that gas boards shall not show undue preference to or discrimination against any person or class of persons. To exclude a consumer from the benefits of a special tariff because he has adopted a system differing only in its means of application from the recognised method can be construed as showing discrimination against him. Such an example came before the S.E.G.C.C. the other day.

Simple Hire for Water Heaters

Consideration had been given at a previous meeting to a letter from the Surrey Federation of Trades Council urging the Gas Board to introduce simple hire for multi-point, single-point, and sink water heaters and indicating that this was done by the L.C.C. at an acceptable rate to their tenants. The Board's view appears to be that it is not economic to install such appliances on simple hire. Surely the solution lies in satisfactory adjustment of the hire rates. It has been argued that any extension of simple hire defeats the object of the current hire purchase restrictions. We feel, however, that these restrictions were imposed with the object of curtailing the purchase of luxuries in a time of economic stress. The gas water heater is not a luxury; it is a necessity.

Consultative Council Chairmen are to be invited to give their views on Mary Stewarts' recent Fabian Society pamphlet on Consumer Councils, and the S.E.G.C.C. propose to hold a special session prior to their next ordinary meeting to state their views on this publication (which was reviewed in the *Journal* of January 21, p. 143). We look forward to some constructive comments.

The Northern Gas Board has approved an extension of a 12 in. low pressure main recently laid to the Red House Estate, Southwick, over a distance of 2,500 yds. to meet the requirements of the new Castletown housing estate. The consumers on the estate are to be given freedom of choice as between gas and electricity following negotiations with the local town council. This low pressure main extension will cost £11,000.

The Scottish Fuel Efficiency Committee is to press for Government decision on the plan to create a National Fuel Trust, with coal, gas, electricity, and oil all co-ordinated to the best use. The Scottish Committee has sent its proposals to the Government, and to other committees in England and Wales asking their support, and has indicated its belief that a consumers' strike is already in operation and will be increasingly evident as the year advances.

IN PARLIAMENT

Implementing the Ridley Report

THERE was a fuel and power session at Question Time in the Commons on February 9, initiated by quite a barrage of questions on what steps the Minister of Fuel and Power is taking to implement the recommendations of the Ridley Committee.

Mr. LLOYD'S announcement that he had set up a small committee of the main industrial interests concerned to work out a scheme for fuel efficiency advisory services got a rather unsympathetic reception. Was it not rather unsatisfactory, commented Mr. GERALD NABARRO (Kidderminster), that in view of the fact that the Report of the Ridley Committee took 16 months to compile and they had had the Report now for five months, that one more committee was being brought into being to say how this industrial fuel advisory service was to be conducted? Could the Minister tell the House unequivocally that this committee would report within a month and that when the report was to hand they would get some urgent and dynamic action without another two years' delay?

The MINISTER was not prepared to commit himself to dynamic action and considered that in a matter in which they required the co-operation of a number of diverse industrial interests, the most practical procedure was to get people to agree and not to issue rather dictatorial decrees.

Lieut.-Colonel M. LIPTON (Brixton) asked the Minister to bear in mind, in connection with proposals for fuel efficiency, the need to do something about the problem of air pollution in London and other large industrial towns, because the one thing linked with the other and there was a need for co-ordination.

Mr. ALFRED ROBENS (Blyth) suggested that with the publication of the Ridley Report, the Minister had all the information he wanted to enable the Government to produce a proper fuel and power policy.

Mr. NABARRO, following the recognised line when Ministerial answers are deemed to be unsatisfactory, gave notice that he would raise the matter on the Adjournment.

Gas Water Heaters

Mr. C. J. M. ALPORT (Colchester) asked the Minister whether he was aware of the decline in the demand for gas water heaters, and what steps he intended to take to prevent the contraction of the use of this efficient method of domestic water heating.

The reply of Mr. GEOFFREY LLOYD: 'Yes, Sir, but this depends on the consumers' choice,' can hardly have been more inconsequential and can have brought no solace to the water heater manufacturers.

Electricity Tariffs

Colonel R. S. CLARKE (East Grinstead) asked the Minister if the electricity boards had now, in accordance with his request, reviewed the wording of their new tariffs, and what report they had made to him on this matter. On being informed by Mr. LLOYD that these reviews would take some time and he had not yet received a report, Colonel CLARKE asked the Minister to ensure that, in accordance with recommendations of the Ridley Report, the boards made certain when reviewing these tariffs, that their charges are truly based on the costs of supply and are free from any form of restrictive covenant.

Mr. LLOYD indicated that the electricity boards had already accepted these principles.

Gas Workers' Lung Cancer

Mr. A. MOLSON (Parliamentary Secretary to the Ministry of Works) replying to a question by Mr. S. T. SWINGLER (Newcastle-under-Lyme) concerning the lines of research into lung cancer among gas workers said: 'The possibility of conducting further research on the incidence of lung cancer among gas workers is still under discussion by the Medical Research Council in consultation with other departments. I am, therefore, unable to make any statement at present about investigations which may be undertaken in the future.'

West Midlands Research

SPECIAL ACKNOWLEDGMENT is made to the Industrial Heating Section of the West Midlands Gas Board for their research and development work in an advertisement in the January issue of *Metal Treatment*. The advertisement is that of the International Furnace Equipment Co., Ltd., of Aldridge, Staffordshire, and deals with the application of the C.C. burner for the treatment of metals. The aim of the engineers experimenting on this development was to increase the actual effective heat energy obtained from the fuel and to control the hot gases within the furnace in order to eliminate temperature variations.

The advertisement adds: 'The credit for the initial experimental research and development work on the C.C. type of burner must go to the Industrial Heating Section of the West Midlands Gas Board to which it is desired to make acknowledgment.' The advertisers claim that new furnace chamber designs to take advantage of the increased efficiencies given by the C.C. burners, are a 'quite revolutionary development.'

Fire Broke Out in one of the 500-ton coke hoppers at Wandsworth gasworks. Centre of the fire was a 100-ton bunker 25 ft. above ground. Extra long hose reels were needed to reach the bunker and the fire was fought from the ground and from a platform on the same level as the bunker.

HOME SERVICE ADVISERS VISIT PARKINSONS

THE recent bi-monthly meeting of the home service advisers of the West Midlands Gas Board was held at the Stechford Works of the Parkinson Stove Company, Ltd., Birmingham. Some 23 demonstrators from all parts of the West Midlands attended the meeting, and were afterwards entertained at lunch by the Directors of the Company. In the afternoon, the home service advisers watched some experiments on the eye-level grill of the new Coronation Renown cooker.

Our photograph shows the party with Miss Olive Humphries, Area Home Service Adviser for the West Midlands Gas Board, in the centre of the front row. On the right is Dr. Rees Jones, Director and Technical Manager of the Parkinson Stove Company, and on the left, Mr. J. L. Anstey, Sales Manager. On the extreme right of the front row are, Mrs. Roy, Deputy Area Home Service Adviser, and Mr. K. F. Hollingsworth, Midlands Area Representative of the Parkinson Stove Company.

STEAM AND POWER IN THE GAS INDUSTRY

The following discussion took place at a joint meeting of the North of England Section of the Institution of Gas Engineers and the Northern Junior Gas Association on the paper by Mr. L. J. Clark, B.E.M., M.Sc., M.I.Mech.E., M.Inst.Gas E., A.M.I.C.E., A.M.I.E.E., originally presented to the 5th International Gas Conference held in Brussels in 1952. An abstract of the paper was published in the *Gas Journal* of September 3, 1952

MR. W. R. GARRETT (Constructional Engineer, Northern Gas Board) stated that, while appreciating that waste heat boilers on continuous verticals should be capable of supplying all the steam and power requirements for a works, this was also true under the best conditions for intermittent vertical chamber installations, providing there was no excessive pressure-raising equipment. He also stated that there was one works in the Northern Gas Board where the steam consumution was slightly less than 10 lb. per therm and where carburetted water gas contributed up to 28% of the gas sent out and where the pumping load was very high.

Mr. Garratt referred to the necessity for reliability of steam supplies, and said he was not happy about chain-grate stokers for Lancashire boilers. If reasonable prices were available for electricity there was no doubt that it offered an extremely simple and effective alternative to steam anti-freezing equipment on gasholders, and for the small single lift holder was probably the cheapest proposition as regards capital and running costs.

In reference to the new Howdon works, he stated that steam was generated from waste heat boilers at 300 lb. per sq. in. with 100° superheat, and apart from the steam used on exhausters the whole was converted to electric power. The engines driving the exhausters and turbo-alternator discharged into a low pressure steam main and supplied all process steam. One of the reasons for adopting such a high steam pressure on waste heat boilers was their comaparatively small size—*i.e.*, 6 ft. 6 in. diameter. He was not certain that he would repeat the scheme using such high pressures. The boilers were of riveted construction, and as far as tightness was concerned were extremely sensitive to normal working conditions. He enquired whether the waste heat boilers on the new C.W.G. plant at Beckton, which were worked at 300 lb. per sq. in., were of riveted construction.

Regarding horse power of electric motors, while he agreed with Mr. Clark that larger motors than were necessary increased the capital expenditure and upset the power factor, he suggested that benefits were obtained by standardisation on certain sizes of motors in order to reduce the number of spares.

Happy Experience

Mr. Clark said he was very interested in the information relating to the boiler plants at Howdon, but in regard to the reliability of chain-grate stokers, their experience at Beckton made them completely happy. Once the operators had become familiar with the technique of breeze burning, there was no danger. On the other hand, he qualified this statement by saying that where there were a limited number of boilers it would not be wise to mechanise them all.

He did not agree with the use of electricity on gasholders, because he preferred to take a national view on this aspect and did not hold in principle with the use of electricity during peak load periods, although he agreed that from a cost point of view electricity could show advantages over the use of steam in certain circumstances. It was no use for the Electricity Authority to install plant which would help the gas industry at odd infrequent periods. The waste heat boilers at Beckton were riveted but not very large. Boilers working above 500 lb. per sq. in. should be wielded.

Mr. J. R. Porter (Manager, Redheugh works Newcastle) said that at his works there were installed in 1948 two Clarke-Chapman tri-drum water-tube boilers, each of 30,000 lb. per hour capacity. He agreed with Mr. Clark that it was preferable, where there was no other stand-by plant, to install a minimum of three boilers. In their case, however, they relied on nine Lancashire boilers for stand-by purposes. The two water-tube boilers were provided with Bailey apparatus for remote control or fully automatic control, and the boilers were designed for the burning of ¾ in. to dust coke breeze, and on full load 21 lb. of fuel per sq. ft. of grate area was effectively combined. They had found that the size and grading of the breeze had a very important influence on the rate of burning, and the largest grade should not exceed ¼ in.; otherwise the hot zone of the fire travelled to the back of the furnace with resultant damage or displacement of the cast iron clinker dams. A fairly high proportion of fines was desirable in the breeze fuel as the ignition was assisted to a large extent by a cascade of the incandescent fines which showered from the firing zone on to the front part of the fuel bed. As a safeguard against loss of ignition, coal gas burners were fitted to the guillotine adjacent to the front arch.

The boilers had proved to be very flexible, and were laid off only once each year for cleaning and examination. It was evident that much thought had been given at the Beckton works to the problem of promoting the ignition of breeze fuel, and the various systems of recirculation were most ingenious. The disadvantages of these systems, in Mr. Porter's opinion, were the high wear and tear of the brickwork forming the arches and the tarry deposits on the fan and ducting, although one would not expect heavy deposits from the use of fuel of such a low volatile content as 1.9%.

Mr. Clark, in his reply, referred to the question of reliability in the use of this type of water-tube boiler and to the fact that normally large boilers might be unsafe without adequate stand-by. He was very interested in the automatic Bailey control. The North Thames Gas Board, even though they had given consideration to automatic systems, had not proceeded with one. They had experienced no trouble with tar in the fans and the recirculating system. In the Beckton boilers the fine fuel carried forward settled in the rear chamber and was re-fired by supplementary burners. He considered that one year's running without shutting down was a good performance on this type of boiler.

Mr. J. McManus (Manager, Howdon works, Newcastle) referred to Mr. Garrett's comments on the new Howdon works and his statement that the electrical consumption was 12.3 kWh per ton of coal carbonised, in comparison with a figure given by himself of from 7-15 kWh per ton. Mr. McManus stated that this figure made allowance for the heavy amount of transmission from the works, without which the figure should cut down to about 9 kWh per ton. He was sceptical of the requirements of 6.8 lb. of steam per therm of gas made, and he thought this figure was too low. He also enquired whether Mr. Clark had found any caustic embrittlement in the boilers working at 300 lb. per sq. in.

Dr. Milner (Ashmore, Benson, Pease & Co., Ltd.) asked for details of the automatic ignition and control on small boilers situated at a distant holder station. He also asked if the use of cement inside coke chutes to prevent corrosion could also be used in the inter-connections on water gas plants.

Mr. K. W. Francombe (Whessoe, Ltd.) referred to the rating of electric motors, and agreed that they erred on the big side rather than on the small side, because if the motors were inclined to be small there would be an outcry from the customers. He referred to voltage drop which increased current consumption and necessitated higher powered motors than was theoretically necessary to cover for this contingency. He also pointed to the fact that they sometimes received complaints from customers because totally enclosed motors appeared to be running very hot, but it was invariably the case that there was no cause for alarm.

Mr. Stanley Jones (Middlesbrough) referred to the efficiency of the gas engine, which was shown as being very low compared with other prime movers. He pointed out that dual-fuel engines, where the gas was subjected to a compression ratio of 14:1, which applied to the diesel engine, resulted in a substantially greater efficiency than obtained in the past when gas engines were designed with a compression ratio of about 6:1. It was claimed that the efficiency of the gas engine

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DOMESTIC HEATING RESEARCH

By J. SHACK, Ph.D., A.M.Inst.F.,

Central Laboratories, Birmingham, West Midlands Gas Board

From a Paper to the Midland Junior Gas Association

THE fuel shortage during the war years focused attention on the largest potential source of fuel economy—domestic heating. A drastic rationing scheme of coal and coke was introduced and while people were prepared to accept this hardship just as much as any other in the knowledge that they were contributing to winning the war, it was obvious that a better long-term solution was needed. The Egerton Committee was set up to study among other things the efficiency of Domestic Heating.[1] This was followed by the Simon Committee which had to translate technical data into political action.[2] The reports of these committees provide the basis for a fuel policy for many years to come.

One of the most important results of their labour was the publication of a list of approved appliances by the Ministry of Fuel and Power, and of minimum standards of performance which an appliance had to pass before it could be included in this list. These tests gave a good picture of its performance under laboratory conditions, and although not entirely satisfactory it was a big step forward compared with pre-war conditions.

It soon became clear that an appliance cannot be considered on its own. It is part and parcel of a room, or, better, of a whole building, and the properties of this larger unit must influence the success or failure in actual use.

Present-day research is concentrating on this mutual influence of house and appliance. The first and most obvious problem was the relationship between the appliance and its flue. A room loses heat partly by conduction through its walls and partly through the flue by ventilation. The latter is not only a channel through which heat is lost into the atmosphere, it is also a recuperator extracting heat from the gas flowing through it, thus adding useful warmth to the fabric, preventing the freeing of pipes, etc.

The efficiency of a recuperator depends much more on the temperature difference between its walls and the gas stream than on the gas velocity.

Double Effect

'Over ventilation' has, therefore, a double effect. It removes more warmth from the room and deposits a smaller proportion of it in the chimney. An example will make this clear.[3]

Consider two flues one carrying a stream of 1,000 cu.ft. per hour at 600°F. the other 4,000 cu.ft. per hour at 200°F. The heat content of both is almost identical but the first will transfer twice as much heat to the chimney. This explains the difference in use between an open convector fire and an openable stove, both of which may have the same test bench efficiency, but their ventilation rates conform closely to the two alternatives of our example, and the stove will provide a warmer house. At least one firm has already made use of this fact. It produced an open fire with an adjustable throat which will reduce the heat loss to the minimum compatible with satisfactory ventilation. This is generally accepted as being 1½-2 air changes per hour.

A logical development from this kind of work, was to convert a whole room with its heating and ventilation system into a piece of laboratory apparatus. This was done in the calorimeter building at the Fuel Research Station[4]. It contains four airtight rooms (12 x 12 x 9 ft.) each mounted in a constant temperature chamber. The rooms contain a heating appliance and the usual equipment to measure its test-bench efficiency. The novel thing in this laboratory is that the real heat input into the room can be determined in the following manner.

In the steady state the room gains exactly as much warmth from its heater as it loses partly by conduction through its walls and partly by ventilation.

To measure the first part the room has been built of plywood of a known thermal conductivity, covered on both sides with copper panels each of which is insulated from its neighbours and furnished with a thermocouple. From the known thermal conductivity of the wood and the temperature difference across each panel it is possible to evaluate the amount of heat lost by conduction.

The ventilation loss is found in the following manner:

Air can enter each cabinet through one opening only which contains an accurate flow meter. The amount of air flowing through the room multiplied by the rise in temperature gives the ventilation loss.

Provisions are also made to measure the smoke emitted from the fire by optical means.

The constant temperature chambers contain fans and a refrigerator to enable the experimenter to produce at will any 'climatic' conditions desired outside the test room. The problem of dependence of the useful heat input into the test room on throat and flue design is one of the subjects under examination.

Impressive Scale of Investigation

The next step was the investigation of conditions in actual houses. This work is carried out by the Building Research Station at Garston[5, 6, 7] and it is on a truly impressive scale. To the best of my knowledge there is no other research project of comparable magnitude in existence dealing with domestic heating. The general scheme of the work was to build a number of houses of standard design each one equipped with recording instruments. For a period, usually one winter, the houses were left unoccupied and run as closely as possible to a routine based on the Egerton Report. Bedrooms were kept at 50°F. except for two periods of one hour morning and night when the temperature was raised to 55°F., living rooms at 45°F. during the night, 55°F. during the morning, and 65°F. during the afternoon and evening.

250 gallons of hot water (140°F.) were drawn off per week and cooking was represented by boiling water. The amount of fuel required was measured every week and allowance made for the prevailing climatic conditions (air temperature and wind velocity, etc.).

The first part of the experiment dealt with a group of eight houses heated by highly efficient anthracite boilers and having varying degrees of structural insulation. This proved conclusively that money spent on such insulation was quickly recovered in fuel saving. Unfortunately, it increases the price of houses and there is some doubt whether it is possible to persuade the tenants that the higher rents are well worth paying.

The second part was on an even larger scale. Twenty houses were erected all of the same high standard of insulation but having different heating and cooking arrangements. According to their heating system, three groups of houses can be distinguished—partial heating, two-stage heating, whole-house heating.

Group 1 (partial heating) resembles the pre-war standard house. The living room only has a proper heating appliance, the kitchen receives heat from the cooker or water heater when in use, the rest is unheated.

In Group 2 (two-stage heating) we find houses with 'background' heating, mainly by hot air ducts. The whole house is kept at 50°F. with topping-up of individual rooms.

Group 3 contains central heating systems of one form or another.

The amount of published information dealing with these experiments is enormous, and it is quite impossible to summarise it adequately in a short survey. Only some of the most important findings can be mentioned and the selection is, of course, a personal one.

The first point that strikes one is that, given first-class

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insulation, pre-war heating equipment can provide suprisingly good comfort conditions. Take House No. 33: There is an ordinary coal fire in the living room, a gas cooker and an independent boiler in the kitchen. The average living room temperature varied from 55°F at 8 a.m. to 65°F. between 4 p.m. and 10 p.m. The bedroom averaged 51°F., fell hardly ever below 40°F. This was caused mainly by insulation which enables heat to be stored in the fabric; it was helped by the fact that windows were kept closed all the time and doors opened only infrequently. Nevertheless the ventilation rate reached 2-2½ air changes per hour, which is sufficient for ordinary usage.

As members of the gas industry we shall be interested to find that the two houses (Nos. 21 and 22) which give reasonably good comfort for the lowest cost are served by a combination of gas cookers and multi-purpose solid fuel appliances, the one burning coke the other anthracite. I have no doubt the latter's performance would be equally satisfactory on coke.

Another conclusion to be drawn from these experiments is the obvious wastefulness of solid fuel cookers. They increase the annual fuel consumption by at least 1 ton. This may not be true for thermostatically controlled, lightly insulated storage cookers but they are far too expensive to be considered in low cost housing. It was a great surprise to everyone that two-stage heating systems were not more successful. It had been expected that this method occupying a half-way position between the traditional ways and the still unpopular central-heating systems would become the dominant feature in modern British building. The Building Research Station experiments seem to prove that there is little justification for the increased capital expenditure involved. If adequate insulation is provided any good partial heating system will give almost equivalent service.

The low running cost of central heating systems is another unexpected conclusion. Two of the three systems with lowest running cost are centrally heated. Unfortunately their installation is still so expensive that it is put outside the general run of low cost housing.

Bewildering Wealth of Data

Coming to the occupied period we find an even more bewildering wealth of data. Again only an outline of Dr. Weston's findings can be given.

The mean house-temperature is in no way a constant, it depends on the outside temperaure: A drop of 1°F. outside reduces the mean house-temperature by 0.5°F. Conditions in the living room, particularly in the evening, are less sensitive. The temperature drops by only 0.25°F. for each degree outside, and this drop seems to be caused mainly by limitations of the heater capacity. If the outside temperature falls from 51° to 45°F., the evening temperature in the living room remains almost unchanged, 65° instead of 66°. But an outside temperature of 33°F. causes a steep decline indoors to 60°F.

It is interesting to note that the spread of living-room temperatures on cold days is much wider than on mild ones. Some householders will push the thermometer up to 83°F., a temperature never reached on other days.

The following are some of the general conclusions drawn in these papers.

Centrally heated houses tend to be warmer than the rest; this may be due to the absence of radiant heat. Their temperatures approach those customary in the United States (70°-75°F.).

It is possible to provide an adequate heat service for a coal equivalent of as little as 4 tons per year. The installation of gas or electric water heaters for summer use saves fuel. The most economical way of dealing with the winter load is by means of a combined space and water heater burning solid fuel. Background heating for bedrooms is unnecessary where good insulation is provided; it is better to use any spare heat in a second room downstairs. Users complain much more about a cold kitchen than cold bedrooms.

Gas or electric cookers should have preference over solid fuel ones where possible.

18 units of electricity provide about the same service as 1 therm of gas.

If the weekly fuel consumption is considered as a function of the outside temperature, one finds a much smaller variation than one would have expected using the customary method of prediction from degree-days. This proves that this method is not applicable for houses where economic considerations exercise an over-riding influence.

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SCIENTIFIC GLASSWORKING

THE laboratory glassblower usually employs simple hand tools, similar to those in use half-a-century ago, and in order to fashion glass into the many forms necessary he relies almost entirely on a high degree of manual skill. This is despite the many technical advances in industrial glassworking as found, for example, in the electric lamp and radio valve industries.

Owing to the great variety and the frequent complexity of scientific apparatus, there has been little interest in speeding and improving its production in the laboratory. Yet every piece of lamp-blown glass apparatus is built from one or more basic forms—*e.g.*, bulbs, cones, various types of joints and seals, etc., most of which could be formed more rapidly and precisely by suitable mechanical aids before their final assembly by hand. Mechanical aids would be particularly suitable for the laboratory production of standard and special types of widely used apparatus—*e.g.*, Dewar flasks, stop-cocks, cone and flanged joints, where the design must be followed rigidly and uniformity of dimension is essential; with such apparatus little or no hand-assembly would be necessary. This need has been appreciated for a long time by the British Coal Utilisation Research Association, with the result that improved methods of glassworking and new apparatus designs have been developed.

A machine has been installed by B.C.U.R.A. to bridge the gap between the employment of skilled glassblowers and the use of elaborate and expensive glass lathes. With this machine a skilled man can increase the speed and precision of his work. At the same time one almost unskilled in the art can produce apparatus for immediate needs. It is more versatile than the conventional glass lathe and can deal with all but the largest and heaviest work in both soft and borosilicate glasses. Electrical indication ensures accuracy of the product to pre-set limits, and the forming tools and burners are inter-changeable. Typical examples of work which may be carried out with the machine are Dewar flasks, graded glass seals, stop-cock parts, cone joints and flanges, spirals, metal-to-glass seals, butt and ring seals, bulbs, and glass bellows. There is also provision for glass-cutting by both flame and diamond; in addition the machine functions as a small glass lathe.

Instrumentation of this type of glasswork is creating wide interest. Protoype models of the machine are already in use in other laboratories, and steps have been taken to make it generally available.—From the *Gazette* (No. 17) of the British Coal Utilisation Research Association.

THE NORTH WESTERN GAS BOARD announces that for the period to April 30, 1953, the price of coke will be reduced by 3d. per cwt. throughout the Board's area for all classes of consumers. The Board states that there are ample supplies for all purposes throughout the North West. Stocks at the end of last week were 288,600 tons, and in addition approximately 39,000 tons are produced weekly for sale. The Board points out that householders generally do not seem to be aware that their entitlement of group 2 fuels (which include coke) for the period November 1, 1952, to April 30, 1953, is up to 30 cwt. above and beyond their ration of coal. Households registered for coke either with a gas undertaking or a coal merchant are advised to place their orders immediately to ensure quick delivery. During the cold spell the Board has made special transport arrangements to accelerate coke deliveries.

DEVELOPMENT OF A SMALL GAS UNDERTAKING

By W. E. WHITNEY, M.Inst.Gas E., A.M.Inst.F.,

Engineer and Manager, Bridgend Undertaking, Wales Gas Board.

From a paper to the Wales and Monmouthshire Junior Gas Association at a meeting at Bridgend and again at a meeting at Caernarvon

THE Bridgend undertaking is a small station with an annual output of approximately 200 mill. cu.ft. per annum. The area of supply covers some 30 sq. miles, but due to sparse population in the outlying areas only 20% of this area has a gas distribution system. For the most part the area over which gas is distributed consists of a town and trading estate and as such is compact, the number of consumers per mile of main being 135.

The past decade has been a period of considerable development for the town of Bridgend. Over this period the town has altered in character from a purely market town to that of an industrial community. The war years brought about this change with the installation of a large Royal Ordnance factory which employed labour from all the surrounding districts.

When the war ended in 1945 the Government converted the ordnance factory into a trading estate. In this way 1 mill. sq. ft. of factory space was made available for light industries.

This in turn brought a movement of population into the town. The population increased from 11,000 in 1939 to the present-day figure of 14,000. These factors had a considerable influence on the demand for gas in the area, which grew from 54 mill. cu.ft. in 1938 to 190 mill. cu.ft. in 1951. The number of consumers has increased from 2,400 in 1938, to the present figure of 3,600.

This expansion has necessitated reorganisation of the distribution system and administration of the undertaking.

In May, 1938, the gas producing plant at the Quarella Road site consisting of six beds of stop-ended horizontal retorts was shut down, and a bulk supply of coke oven gas was taken from the Garw and Ogmore undertaking. The agreement for supply specified a maximum of 75 mill. cu.ft. per annum. A 5 in. dia. steel main was laid from the Garw works to supply gas into the Bridgend holder. This main was constructed with welded joints and is approximately 3½ miles in length.

Hospital Gasworks

A large mental hospital is sited adjacent to the route of the bulk supply main. At the time when supplies were taken from Garw this hospital operated its own gasworks and produced 7 mill. cu.ft. of gas per annum. An agreement was made with the hospital authorities to supply gas direct from the bulk supply main to the hospital premises.

Since 1938 the gas consumption of this consumer has increased by 20%, and is now 10 mill. cu.ft. per annum. Gas is used for space heating. Kitchen equipment and recently two large baking ovens have been installed for baking all the bread for hospital requirements.

The coke oven gas passing into Bridgend holder is governed to 10 in. W.G., and metered on a B.M. meter of 12,000 cu.ft. per hour capacity. The flow of gas is at present regulated manually. The consumption of gas from this source exceeds the volume of 75 mill. envisaged in the original agreement, and is in the region of 120 mill. cu.ft. per annum.

With the development of the trading estate it became necessary to acquire additional gas and accordingly arrangements were made with the Port Talbot undertaking for the supply of gas in bulk direct to the trading estate. The scheme was carried out with the approval of the Ministry of Fuel and Power and the Board of Trade and a development of industry loan was advanced for this purpose. Facilities already existed for supplying gas direct from Bridgend town mains to the estate via a 6 in. connection.

The supply of gas from Garw undertaking is expected to cease in 1957. Hence the new bulk supply main from Port Talbot was designed with the view to supplying the whole Bridgend and Garw load by that date. The scheme entails the laying of a further section of 10 in. diameter main from Bridgend to Garw works. A 10 in. diameter spun-iron main with screwed gland connections has been laid from the Port Talbot main at Pyle to the trading estate. Gas is supplied to the estate via 8 in. Reynolds relay governors arranged in duplicate. The pressure at the inlet governor is 2 lb. per sq. in., and the outlet pressure is regulated to 10 in. W.G. The gas is metered through a 60,000 cu.ft. per hour B.M. meter. The volume of gas at present received from Port Talbot is 80 mill. cu.ft. per annum.

Gasholder and Boosting Plant

The existing storage capacity at Bridgend works is 250,000 cu.ft.

The maximum daily output to Bridgend and the estate is now 800,000 cu.ft. The existing storage capacity is inadequate and it was decided to erect a holder of 500,000 cu.ft. capacity. The site chosen was the trading estate. The holder will be constructed by Robert Dempster & Sons, Ltd., of Elland, and the foundation by F. C. Construction Co., Ltd. The holder is of the spiral-guided type and consists of three lifts mounted in a steel tank above ground.

Arising from pressure requirements on the trading estate it was specified that the holder should throw a pressure of 12.3 in. W.G. when fully inflated. A pressure of 8 in. W.G. will be obtained when the outer lift uncups. It is necessary to maintain a pressure of 10 in. W.G. in the estate mains. Arrangements have therefore been made to boost pressures to the requisite figure when the holder is worked in the outer lifts. The booster for this purpose will be a Bryan-Donkin two-stage Rateau turbo-type of 50,000 cu.ft. per hour capacity. The machine will be powered by flame-proof motor of 3 B.H.P. The pressure difference across the machine will be 8 in. W.G.

The inner lift of the holder throws a pressure of 5.4 in. W.G. Thus the pressure requirements of the trading estate will be attained.

The holder site will not be manned and the booster will be automatically controlled. Provision has been made for the installation of a further booster should this be deemed necessary.

A connection with suitable control valves will be made from the booster outlet to the inlet of the high-pressure governors. This will enable gas to be delivered from the holder under booster pressure back to the grid main at the rate of 50,000 cu.ft. per hour. If a duplicate booster is installed this volume will be doubled and the procedure may be extremely useful in the event of a sudden breakdown of supplies to other undertakings on the grid.

The holder will be of riveted construction throughout and anti-freezing equipment will be incorporated.

The old distribution system that served Bridgend for many years was based upon an 8 in. trunk main which supplied the district from the holders at Quarella Road. The

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development of new housing sites to the south and west of the town rendered this system inadequate. In 1942 a new 12 in. trunk main was laid from the outlet station governor to the town area, subsequently this main was extended by 730 yards in 1945 to supply the new residential district in the south.

The Bridgend Council planned to carry out the bulk of its post-war building in the Cefn Glas area to the west of the town. A total of 400 additional houses was initially planned. These have now been erected. Further housing development was envisaged in our estimates at the time. An 8 in. cast-iron trunk main with flexible joints was laid to supply this area. The first 200 yards of this main was laid with 10 in. diameter pipes and connected to the 12 in. trunk main leaving the works. A gas supply was arranged to a large bakery near the works off this main. There are now 27 miles of main in the Bridgend area.

In Wales there has been a considerable loss of revenue due to high unaccounted-for gas figures. The Bridgend area has no special problem of ground movement and the like, and hence unaccounted-for gas has never been a major problem. At present the gas unaccounted-for is 2%.

In Bridgend we have discontinued the use of 3 in. cast iron pipe. As far as possible all mains are laid in the verge and footways with 2 ft. cover. We have a clay subsoil and this has been found to be non-corrosive. Despite this great care is taken in the protection of all steel pipes. We have a few existing steel mains in the town, but for the most part all our mainlaying is now carried out with Class B spun-iron using flexible joints.

We purchase steel tubing unwrapped and wrap as required with 'Denso' wrapping. I feel that pipes purchased already wrapped suffer wear and tear on storage with subsequent damage to wrapping which can be troublesome. Hand wrapping is costlier but when related to the size of undertaking I feel it to be justified.

All Pipes 'Ringed'

Regarding the mainlaying operation, we 'ring' all pipes before laying and ensure that they are laid on a firm level bed. Care is taken to avoid 'cramping' joints beyond the makers' recommendation. All pipes are tested as laid. Where possible an air pressure test of 12 in. W.G. is applied. Where mains are laid 'live' all joints and pipes are smeared with soap solution prior to back-filling. A similar test is applied to all service pipes.

In the Bridgend area all the main roads are maintained by the Glamorgan County Council and subsidiary roads by the Bridgend and Penybont Councils. Permanent reinstatement of subsidiary roads is carried out by the gas undertaking. The main roads, however, carry heavy traffic and hence the County Council carries out the reinstatement thereon. We thought that this was the best proposition in the circumstances as the County Surveyor has all the specialised equipment necessary for carrying out this work to the specified standard.

In regard to new estate mains, as a general rule the policy is to lay dual mains throughout.

In estimating main sizes for new estates I use a maximum hourly flow of 20 cu.ft. per hour per consumer as a working basis. Many authorities on this subject have specified a rate of 30 cu.ft. per hour, but this is based on a complete heat service and is thus a purely academic figure. The location of the gas main in the foot-path in relation to other public service should be decided upon in consultation with the local authority and other services.

Ministerial approval has been received for supplying gas to all the houses in the Cefn Glas area. Each house will be equipped with point for cooker, boiler, poker, and two gas fires. These are installed at the expense of the Council on the Board's standard terms. The appliances are purchased by the tenants, and points exist for fitting electric appliances. Furthermore, it is the policy of the Council to install a solid fuel range in every house. We have made frequent proposals to the Council with a view to fitting gas equipment as standard, but hitherto without success. Members will appreciate the difficulty of effecting sales under the conditions mentioned. However, despite this, 80% of the houses occupied to date are equipped with gas, and 70% have gas cooking appliances.

Industrial and Commercial Consumers

The site of the trading estate covers an area of 450 acres. The tenants are chiefly engaged in light industries. They include manufacturers of such varied products as furniture, chemicals, vacuum flasks, and plastics. In all there are approximately 100 tenants and the employees number 4,000. An estate of this size with its extensive layout and large consumption is equivalent to a complete distribution system from the administrative and maintenance aspects. The distribution system consists of 6 in. water mains converted to gas supply mains with service connections to the various factories. The total length of mains converted is approximately six miles. Syphons have been fitted to all the known low points in the system. A 6 in. ring main is laid around the periphery of the estate and a further 6 in. main runs the full length of the estate along the central roadway. These mains are connected by numerous 6 in. branch connections.

The present gas consumption on the trading estate is 80 mill. cu.ft. per annum. At peak load periods with flows up to 35,000 cu.ft. per hour the existing mains system is loaded to full capacity.

To maintain pressures at peak load periods an initial pressure of 10 in. W.G. is necessary on the outlet high pressure governors. Any substantial increase in gas consumptions on the foregoing figures will necessitate higher pressures in the distribution system and the use of service governors. This method is considered to be the most economic expedient in the circumstances under review. In fact, this scheme is considered to be an excellent proposition even in the present circumstances and arrangements are well in hand to carry out this work.

The bulk of the bread baking in Bridgend is carried out in gas-fired ovens and the present annual consumption is 20,000 therms. The majority of the bakers operate on a small scale and use static type ovens.

We have a large number of central heating installations in the area fitted in churches, commercial premises, and large dwelling houses. We have a special tariff for this class of consumer which we have extended to cover flueless space heating on installations of six units and over. Many flueless overhead heaters have been fitted of late years ranging from single unit installations to one of 40 units fitted in a large school.

Despite the many advantages of flueless heaters great care must be taken to ensure that they are fitted only when circumstances are favourable to their adoption. Adequate ventilation, fixing height, and volumetric capacity of room are all vital factors in an installation of this type.

The total number of domestic consumers is 3,000, of which 2,800 have prepayment meters.

At present the average consumption per consumer is 95 therms per annum. This figure is not considered satisfactory and considerable effort, particularly in space heating and water heating sales, will be necessary to elevate the figure to any appreciable degree. Current adverse factors which affect domestic sales are the decline in spending power, hire-purchase restrictions, higher gas prices, and the ban on advertising.

The replacement of old inefficient appliances, principally cookers, with new models also reduces the gas consumption per consumer, though such a procedure is necessary.

In the past consumers' installations have not received routine maintenance, with consequent detrimental results to the gas undertaking arising from poor pressures, bad adjustment of

burners, and old or faulty meters. We have now commenced routine maintenance in the area and it is planned to visit every consumer once every year. It is anticipated that the first cycle will be the longest due to arrears of maintenance work.

The fitter visits on an average five consumers per day on the older property. It has been found necessary to enlarge meter inlets and tidy lead piping on 75% of the older houses visited to date. The average cost for this type of property has been 12s. 6d. per house, this figure will obviously be lower on the next visit. I feel that this cost is justified on the grounds of consumer goodwill, sales of replacement parts and appliances resulting, and reduction in unaccounted-for gas.

DISCUSSION

Bridgend Meeting

Mr. H. Buckley (President, Pontypool) noted Mr. Whitney's very good figure for unaccounted-for gas, and pointed out that when Mr. Whitney had fitted the governors which he proposed on the industrial consumers on the trading estate, the unaccounted-for gas would fall by over ¼%. He also noted that the Bridgend undertaking was employing what were virtually maintenance salesman adjusting the appliances on consumers' premises. He felt that the cost of 1½d. a therm of gas sold was rather serious but, no doubt, this would reduce as the scheme became more established. Mr. Buckley said that, as far as he could see, the arrangement for the automatic control on the gasholder was not 100% safe in that it appeared to him that if the grid supply failed when the holder only contained a small quantity, the booster would stop but gas could still flow out of the holder. There was, therefore, danger of the holder grounding since it was on an unattended site. He could not agree with Mr. Whitney regarding the use of a gas-fired boiler for anti-freeze purposes on the gasholder. While he appreciated that the holder, being on an unattended site, was going to be difficult to fire manually, he felt that to use gas for this purpose was wrong, particularly in view of the fact that the gas would only be required for anti-freeze purposes during periods of peak demand. There was a tendency for undertakings taking bulk supplies to forget that, during these periods, the works making the gas would be stretched to their utmost capacity and could ill-afford to allow gas to be used for such purposes.

Mr. Whitney agreed with Mr. Buckley that the gas could still flow from the holder. He said that, in choosing a gas-fired boiler for anti-freeze purposes, he was concerned about reliability. While he agreed that it was unfortunate to use the gas for this purpose during peak demands, he felt that oil needed more attention as well as requiring ancillary electric plant. Moreover, he had a very small labour force from which he could call to fire such a boiler.

Mr. K. Muir (Wellington Tube Works, Ltd.) noted that Mr. Whitney preferred unwrapped steel tube. He felt it would pay to have a percentage of both black and wrapped pipe.

Mr. Whitney said that the danger with wrapped pipes was that their protection was frequently taken for granted. With an unwrapped pipe any corrosion was noticed and could be remedied, whereas wrapped pipes were frequently damaged before being laid but the damage was not noticed. He used steel pipe on internal as well as external work, and some wrapping had to be applied to bends and other fittings. He favoured wrapping the whole of the pipe.

Mr. Gray (Neath) commented on the low unaccounted-for figure of the Bridgend undertaking, and asked whether it had gone up since the trading estate had come into full operation.

Mr. Whitney said that the unaccounted-for figure was worse since the trading estate had developed.

Mr. W. F. Edwards (Port Talbot) said he knew from bitter experience how the demand by gas fired anti-freezing boilers could be a serious embarrassment during cold weather.

Mr. Stanley Armitage (Parkinson and Cowan (Gas Meters), Ltd.) said he knew of one undertaking where over 114 holes were found in 15 ft. of 12 in. wrapped steel main, and he felt that Mr. Whitney's fears regarding wrapped pipe were founded on practical experience. He noticed that the Bridgend undertaking did their own reinstatement for the local authority. He presumed that this meant mains as well as services, and he wondered whether this was economic and whether the Bridgend undertaking had any plant for this work or whether they employed contractors. He did not agree with Mr. Whitney's figure of 20 cu. ft. per hour per consumer as the maximum hourly demand, and felt that this would be nearer the average hourly demand. He thought that the Sunday lunch load would require something more than that, probably in the region of 25 to 40 cu. ft. per hour.

Mr. Whitney said that, as regards reinstatement, the Council had the power to do its own if it wished, but it was satisfied with the way the Bridgend undertaking did it. Regarding the flow per consumer, this figure was purely domestic, and it proved satisfactory in the north.

Mr. R. H. Hanford (Port Talbot) noted that Mr. Whitney tested his low pressure mains to 12 in. W.G. The Institution of Gas Engineers recommended 5 lb. per sq. in., and at Port Talbot they tested them to 10 lb.

Mr. Whitney said that about 75% of their low pressure mains were laid live, and, therefore, could not be tested. High pressure testing added very considerably to the costs.

Mr. A. D. Mason (Cardiff) pointed out that Bridgend was one unit of the group, and if all the units of the group were to go forward and fit gas-fired anti-freezing boilers, the position would be so serious that in a period of cold weather and peak demand it would be impossible for the group to meet its commitments.

Mr. Amose (Surveyor, Bridgend Urban District Council) said that subsidence had occurred in a number of areas in Bridgend and, in actual fact, there was not a satisfactory bench mark on any buildings in Bridgend, and it was, no doubt, for this reason, that a temporary bench mark had been used when surveying the site of the gasholder. As regards reinstatement, he said that the gas undertaking was the only undertaking doing its own reinstatement and, so far, it had carried out the work satisfactorily. Regarding the wish of Council tenants in all electric houses to have gas, he said he welcomed the change, as the cost of repairs to the electric appliances was a very serious matter for the Council.

Caernarvon Meeting

Mr. C. Butler (Rhyl) suggested that the losses from mains and services due to boosting coupled with the bias in registration of meters would normally exceed the figure of 2%, neglecting other losses. He also felt that the hand wrapping of service pipe was neither as cheap nor as efficient as the purchase of modern security wrapped tube, and further enquired of Mr. Whitney whether the use of the water main for gas supply had occasioned any difficulties regarding the internal coating.

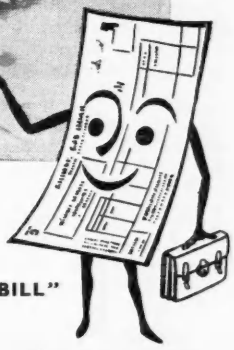
Mr. O. P. Cronshaw (Rhyl) said that in the Rhyl area consumptions of 150 therms per annum were being obtained on post-war council houses, and up to 200 therms per annum on 'prefabs.' He emphasised that in a holiday resort like Rhyl, due to the impossibility of segregating domestic and commercial consumption on premises ostensibly used as boarding houses, it was extremely difficult to design a satisfactory tariff. He would like to know whether the gas purchased and distributed was corrected to S.T.P. and also the oxygen content of the gas.

Mr. W. Eaves (Colwyn Bay) enquired whether any difficulty had been experienced with supplying gas on the reclaimed water main due to the absence of syphons. How many fitters were required to put Mr. Whitney's maintenance scheme into operation?

Mr. W. I. Parry (Flint) asked what was the minimum size of service now being laid.

Mr. Whitney, replying to the discussion, expressed his regret that the low unaccounted-for figure should be the subject of so many sceptical remarks, and added that the gas bought and sold was not corrected to S.T.P. Such a correction would reduce the figure still further. He felt that a major factor was the routine maintenance scheme which required the full-time services of one fitter. The use of the water main for supplying gas to the trading estate had created no difficulty, and syphons had already been fitted at all known low points. This supply main was, incidentally, 10 ft. below the surface.

He agreed with Mr. Cronshaw regarding the useful loads to be obtained from council house schemes, but felt that much load had been lost in South Wales due to abundant supplies of cheap solid fuel, and to the favouritism shown to the council-owned electricity undertakings in the past. In his particular undertaking the erection of council houses very often meant a reduction in the average consumption per consumer due to the factors he had mentioned. The smallest size of service now being laid was 1 in. The bulk supply gas had an oxygen content of up to 1%, but no difficulty had occurred, possibly due to the fact that most of the moisture in the gas had been deposited in transition to Bridgend.



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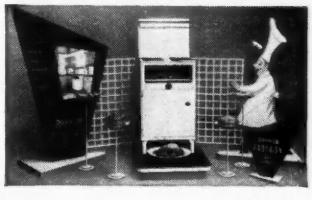

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Gas Meter Design

By STANLEY ARMITAGE, Assoc.M.Inst.Gas E.,
Parkinson & Cowan (Gas Meters), Ltd.

From a paper to the Eastern Junior Gas Association

IN several recent papers I have discussed at length the operation of the gas meter together with its application both to the requirements of the consumer and the gas undertaking. Further reflection on this theme suggests that it may be of interest to those concerned with the technical side of gas distribution to hear a little more of meter construction and development.

It is well, however, once again to recall to mind the task which is expected from a meter. It is the ability to pass a volume of gas between inlet and outlet with a minimum of pressure loss and simultaneously to measure and record the volume of such gas, the whole operation to be accurately continued for an indefinite period of time.

Accuracy of registration is obviously the prime essential in a meter with the maintenance of minimum pressure loss from inlet to outlet second in importance. It is in fact true that a high pressure loss is detrimental to registration.

The breakdown of pressure loss is, of course, as follows:

(a) Mechanical loss due to friction in the moving parts.

(b) Induced mechanical loss by the apparent increase in weight of meter valves due to the rising pressure difference across them as the flow rate increases.

(c) Gas-way loss due to restriction of flow in the meter passages.

It will be appreciated, therefore, that the elimination of such loss is the theoretical target of the meter designer and his approach to the problem will repay study.

It is only in comparatively recent years that research, both chemical and physical, into the quality and suitability of raw materials used in gas meter construction has been adopted as an essential feature of the meter factory. For example, in the past similar metals were often used as bearing surfaces without a great deal of discretion in respect of the resultant friction and wear. Today, however, the adoption of such improvements as stainless steel eyelets on phosphor bronze shafts and, where metal valves are still in use, adjustment in the alloy constitution of covers and seatings, have had a considerable influence on the improvement in both life and efficiency of the modern product.

Another feature is the almost universal adoption of materials to British Standards Specification for all components, thereby ensuring a greater consistency in the finished meter.

Plastic Graphite Covers

The meter maker's laboratory is always investigating the use of new materials which may add to efficiency, a typical example of such research being the plastic graphite valve cover.

This type of fitting was originally introduced some years ago and the experience gained has resulted in its ever-increasing adoption. The cover in question is of a phenolic thermosetting plastic material containing a proportion of pure graphite. It is, of course, completely inert in coal gas.

The advantages are many—in particular:

(1) Self-lubricating due to the molecular structure of the graphite.

(2) It tends to inhibit condensation and deposition of foreign matter.

(3) The material lends itself to extremely accurate manufacture.

(4) Microscopic examination has shown it to be:
  (a) More resistant to wear than metal.
  (b) To wear absolutely horizontally against a slightly uneven result with a metal valve under similar conditions.

(5) It can be made stronger than a metal valve due to its low specific gravity which permits an increased sectional thickness without adding to resistance.

Diaphragms

There is no component of greater importance in a gas meter than the diaphragm, and careful selection of suitable material is therefore vital.

The technicalities of leather processing, etc., are in themselves the theme of a large industry, and it is beyond the usual field of the gas engineer normally to investigate them in detail. I feel, however, that perhaps too little attention is paid to this important matter by our industry, and I propose, therefore, to put forward a few basic details relating to the diaphragm which eventually finds its way into the meter.

The qualities required in a diaphragm are that it must be:

(a) Completely non-porous.

(b) Of soft and easily pliable nature.

(c) Constant in area and softness throughout its life.

(d) Inert to the chemical content of town gas.

(e) Capable of standing up to constant mechanical stress for unlimited periods with an absolute minimum of resistance to the gas meter operation.

Despite the many experiments which are carried out regularly on synthetic materials, leather still proves to be pre-eminently the best material for meter leathers—leather made from the skins of the East Indian (non wool-bearing) hair sheep being the best. This latter is desirable because, unlike the normal British domestic type of wool-bearing sheep, it has no layer of fat midway between its upper and lower surfaces. In the case of wool-bearing sheep, during the pre-tanning and tanning processes, much of the fatty layer is removed, and this creates a spongy layer which would lead to porosity, whereas the use of hair sheep avoids this trouble.

Prior to arriving in this country the skins have been vegetable tanned by the use of local tree bark, etc. This ensures that they are non-putrescible and non-porous, though too firm for use for gas meters. In this state, however, the material is extremely prone to chemical attack, in particular from ferrous metals. A small degree of vegetable tan is, therefore, washed from the leather and replaced by a semi-chrome tan, the basis of which is chromic oxide.

This double tannage, called, rather misleadingly, semi-chrome tannage, has the quality to make the diaphragm resistant to chemical attack, very soft and pliable, and conforming to the standards laid down above, provided the finished skins are impregnated with suitably compounded oil dressing.

(*Continued on page 407*)

Perhaps the key to diaphragm quality is its degree of three-dimensional flexibility, for, while in operation, the leather fibres are moving in a multiplicity of directions. It is at this point where the bulk of synthetics have failed, since they are invariably only two-dimensional in movement and tend either to break down or to create an undue resistance when involved in normal meter operation.

The ability of Indian sheepskin in this direction is well confirmed by the following recent test in a meter laboratory:

> An undressed diaphragm was put through 14 mill. cycles in one month or approximately 70,000 per working day. At the end of this marathon trial there was no sign of wear.

After the chrome retanning the skins are carefully neutralised to avoid potential corrosion of the metal parts of the meter, thoroughly washed, and impregnated with an emulsion of neatsfoot oil and soap, known as fatliquor, and, after drying, the leather is subjected to finishing operations which give a surface to the skin designed to enmesh the graphite particles of the oil dressing.

The prepared diaphragms are now immersed at room temperature in a suitable oil dressing which contains compounded oil, emulsified with petroleum jelly and graphite. The immersion is for three days, after which the diaphragms are laid in piles of 250 for a minimum period of 14 days, reversing the piles each day to ensure even drainage. The thickness of the diaphragm varies according to the size of meter and is measured by a dead weight plunger type gauge, in accordance with the standard method of the Society of Leather Trades Chemists and American Leather Chemists Association.

The industrial meter diaphragm is, of course, too large to be made from sheepskin, and ox-hide is used as an alternative. The blemishes caused by scars or the likelihood of holes caused by attack on the living animal by the warble fly result in only one in every few hundred hides being up to the standard required in meters. The problem for very large sizes is made even more acute by the present day trend to grow small cattle producing moderate joints of beef to meet the need of the modern small family.

Avoidance of Running Pucker

To summarise this section, I suggest that with the above facts in mind it is well to instruct your meter repairer to pay special attention to leather tying in order to avoid what is often referred to as a running pucker or, expressed more simply, a pinch in the leather by the tying wire which will cause an unnecessary amount of fibre movement in one part of the diaphragm with a tendency for this point to fail earlier than the rest of the leather. Deterioration in diaphragms will almost certainly occur if ammonia is allowed to enter the gas stream, even for a short period. Also, the presence of naphthalene crystals on the diaphragms will tend to tear the leather.

It will be seen from the above that too much attention cannot be paid to the background of the diaphragms which are used and that a careful study of diaphragm specification is an essential feature of any meter policy.

The recent innovation of the use of butane/air mixture has special significance to the diaphragm and is dealt with in a later section.

Obviously only the highest quality of tinplate can be contemplated for gas meter construction and, to ensure that such standard is maintained, laboratory tests for thickness of tincoat and porosity are constantly undertaken on raw material. It is, however, pleasing to note that the occasions upon which a check proves the material below specification are very infrequent.

Having ensured that only the correct quality of selected materials is utilised, equivalent care must obviously be exercised in the actual production of each component part. This is achieved by the use of the most modern machine tools and other equipment, by the employment of highly skilled operatives, and by the provision of adequate inspection at all stages of manufacture.

Finally, complete inspection of components selected at random is made by using comparators and projectors which magnify contours by fifty times.

Design

With the intention of using materials of maximum suitability, there next comes the vital problem of designing the meter in such a way as to use each component to the most efficient degree from a mechanical standpoint while at the same time ensuring that the gas meets with minimum restriction during its passage from inlet to outlet. With this in view very careful attention must be paid not only to the layout but also to application of every force between the diaphragms and valves. This ensures the maximum mechanical efficiency, which in turn reduces to a minimum all the bearing loads and stresses on the parts.

The valve seats must be disposed in such a manner as to allow direct feeds to and from the diaphragms and out of the meter with large passageways throughout.

It is preferable that the valves should be of radial design resulting in very rapid opening with large ports and fine bearing surfaces to inhibit deposition of foreign matter, etc.

All shafts, etc., while obviously needing to be of sufficient diameter to cope with their allotted task, should be kept to a safe minimum diameter, thereby reducing friction.

Continued emphasis on the elimination of restriction to the gas flow provides a most emphatic argument in favour of what is known as the open valve principle as distinct from the design where the valves are enclosed in a separate chamber within the meter top section.

The 'open top design' is undoubtedly the outstanding step forward in modern meter design. Open meters provide the following advantages.

(*a*) Omission of the small restricted valve chamber gives a more direct passage of gas through the meter.

(*b*) In the enclosed valve meter it will readily be seen that atmospheric pressure is present at the top of the flag rod stuffing boxes while gas mains pressure is present below. Therefore, the stuffing in these boxes must be capable of withstanding this pressure difference and is accordingly heavy, thus adding to the friction in the movement of the flag rods. In the open top meter, however, gas pressure is present in both sections and only a very small difference, due to a proportion of the meter pressure loss as described earlier, can possibly occur. This enables the stuffing boxes to be packed far more lightly than in the enclosed valve type and friction is consequently greatly reduced.

(*c*) The enclosed valve meter requires a crank stuffing box which must withstand mains pressure and is, therefore, necessarily of liberal size. This, together with the multiplicity of crank surface travel (one revolution per meter cycle) and heavy stuffing results in a higher pressure loss accompanied by greater stresses than with the open top variety where no stuffing box is required at this point, but is instead situated at the index gland and through which passes an index spindle of small diameter, revolving at only 1/20 per revolution of the crank, the approximate effect being something akin to 1/50 of that created by the enclosed valve meter.

The above lessening of friction reduces the mechanical pressure loss to such an extent that a great reduction is brought about in the bearing loads and stresses of all the mechanical parts of the meter, including diaphragms, with an accompanying extension of life and reliability.

Registration consistency is partially dependent on that of friction in the meter. As this latter is greater in the enclosed valve type, the registration is likely to be checked to a correspondingly greater extent.

Contrary to many beliefs, the open top meter is more resistant

to corrosion than the enclosed valve type. Actually, on most of the latter type where the valve plate has become 'pitted' it has been proved that the corrosion has originated at the top of the tinplate due to condensation of moisture which has entered the atmospheric chamber through the index frame when changes of temperature and pressure have taken place. In some extreme instances free water has been found on the valve plate top surface when the meter top has been removed for inspection. Such conditions have a detrimental effect on the index in addition to the other parts of the meter.

It may be argued that the above is countered in the open top meter by the fact that the gas is in contact with and will attack the crank mechanism and index. To avoid such action all parts of the open top section are heavily tinned and in the most recent models bearing eyelets of non-corrodable burnished stainless steel are used, together with spindles of corrosion-resisting metal. The gearing is enclosed in a gear box which is packed with graphited grease which both protects the gearing and permanently lubricates it. On the enclosed valve meter such lubrications can only be achieved with inconvenience.

Assembly Methods

The fact that the modern gas meter is an instrument required to work within very fine limits has necessitated its assembly by precision methods. Gone are the days when such work could be left to the individual operator. Today it is essential that special assembly jigs are provided and that inspection and test are carried out at each stage.

These production tests, which include sounding gas ways, valves, and pressure testing of diaphragms, are quite apart from the final registration test and are undertaken by using a standard manometer gauge calibrated and designed according to Ministry of Fuel and Power specification. This instrument is similar in every respect to that used in the Ministry testing stations. It is interesting to note, however, the practice of meter makers to design their product well within the permissible limits laid down in the Gas Meter Regulations (1949) No. 790.

Open top meters are generally tested by suction instead of pressure. This is because they are calibrated with the top off. Similar testing equipment can be used for suction testing to that required for pressure testing, but in the former case the test holder is weighted to produce 2 in. W.G. vacuum and the test is commenced with the holder down so that, as it proceeds, air is pulled through the meter into the holder.

The meter outlet is connected to the holder inlet and a gauge connection taken from just above the meter outlet to one limb of a gauge or manometer. This gauge indicates the differential pressure and oscillation. A rate of flow cock can conveniently be incorporated in the outlet from meter for controlling the required testing flow.

There is a very slight difference in registrational accuracy when testing in the above manner compared with a pressure test with the top on. This difference can easily be ascertained and allowed for by testing a meter with top on by pressure instead of suction.

The vacuum or suction method of test is a more convenient system of calibrating open top meters than the older method of having a loose small top which was temporarily attached by cement.

In addition the top mechanism and valves are clearly visible during calibration.

Meter Speed

The advent of these small case meters operating at speeds in excess of previous designs has led in certain instances to the suggestion that they are, as a result, overworked and will fail after a comparatively short life. It is well, therefore, that this matter should be brought forward and considered in the light of the facts.

I take as an example the D.1/200 meter which has a D.1 size case and is badged at 200 cu.ft. per hour. The speed of such a meter at its rated capacity is 2,000 rev. per hour or just over one revolution every two seconds.

In the early part of this paper I have pointed out that the meter designer today is producing an article which is in effect a precision instrument of strength in design, equivalent to many high speed machines where rates of hundreds of revolutions per minute are considered commonplace. Why, therefore, consider a meter overworked when at a maximum it is revolving at only the microscopic figure of 33 revolutions per minute? Actually, the speed is so slow that the wear as a result is completely negligible. It may be asked, 'Why was a figure of 120 rev. per hour for so long felt to be the maximum safe speed for meters?' No doubt this was because such a speed represented the capacity operation of an original 5 lt. type (30 cu.ft. per hour), which, by virtue of its inferior design (very small valves, small gas-ways, inadequate bearings on moving parts, etc.) when compared to the modern meter, probably had a maximum safe speed of only 120 rev. per hour.

However, this bears no relation to present-day models and should not be considered as a basic standard. A parallel which illustrates such a relationship is the development of the motor-car. One would never dream of condemning the engine speed of a modern automobile because it is in excess of that of a design produced some 30 years ago! The gas meter is more than comparable with this, for even today the most rapid meter revolves at an extremely low rate in relation to its design.

It is probably fair to estimate that the average hourly consumption of a normal domestic consumer is around 30 cu. ft., at which rate the modern gas meter operates with negligible pressure loss. However, the design is such that it can be relied upon to deal quite comfortably with the intermittent peak load periods and at the other limit to record accurately the very small by-pass, refrigerator consumptions, etc., when they alone are consuming gas. Undoubtedly with the high cost of fuel today this latter recording is most vital to the undertaking.

Butane/Air

Recently experimental plants have been installed in Britain to produce a mixture of butane/propane in vapour state mixed with air to supply small undertakings where the local production of coal gas has become uneconomic and where integration is impracticable. This venture has a special significance to the meter in that butane is an active solvent and, as such, the possibility of loss in diaphragm dressing has to be considered.

The manufacturers of butane/air plants are, of course, fully aware of this problem and have constructed their equipment so that the butane bubbles through crude benzole, and the air through gas oil just prior to the mixing plant in an attempt to simulate the equilibrium conditions found in town gas and thereby to obviate the removal of the oil dressing.

Diaphragm Dressing

(a) *Meters existing on the district when the change-over to butane/air takes place.*
During the course of normal working with coal gas the oil dressing in the diaphragm absorbs hydrocarbons from the gas until it is in equilibrium with the gas itself. The oil dressing gains in volume and loses viscosity with the result that a percentage of the oil dressing drains from the diaphragm. In this state the diaphragms normally give no trouble and will continue to operate without a hitch for many years. However, on the change-over butane may extract these hydrocarbons with a resultant hardness of the diaphragms and fast meter readings as a prelude to a possible breakdown.

(b) *Meters fitted new for use with butane/air mixture.*
In this case there is every reason to expect a longer life than with the part coal gas used examples where.

as previously stated, the dressing has already been subject to dilution. It is advisable, however, in such circumstances to utilise a dressing which is less solvent and thus provides a further insurance against failure. Special dressing has been devised by gas meter makers to deal with this work.

DISCUSSION

Mr. F. G. Cox (Norwich) enquired whether the considerations that had led to the wide introduction of the open top meter were fully justified. Were low consumptions—*e.g.*, refrigerators and by-passes, accurately recorded over long periods?

Mr. Armitage replied that it was only after the maximum technical research coupled with the confirmation of exhaustive tests that the open topped meter was introduced. Pressure loss in this design was reduced to an absolute minimum, and tests for accuracy were carried out at as low a consumption as ½ cu.ft. per hour.

Mr. B. Halls (Cambridge) asked whether Mr. Armitage was in favour of periodic lubrication of domestic meters.

Mr. Armitage said that this was not necessary or desirable due to the resulting boundary film resistance. Domestic consumption varied so considerably that the effect of oil films must differ. In some cases the tendency might be to over-oil, and, in others, the reverse. In his opinion it was far better for manufacturers to design meters with self-lubricating materials wherever possible, one such example being the graphite-impregnated plastic valve cover.

Mr. R. W. Hilham (Colchester) enquired whether Mr. Armitage's remarks applied equally to lubricating industrial meters.

Mr. Armitage said that providing lubrication was continuous he would recommend the method at present, but he hoped the future would provide satisfactory self-lubricating materials to render this unnecessary.

Mr. R. F. Robinson (Watford) expressed the view that fundamental meter design showed little change over many years, although detail improvements had taken place. He would have expected a reduction in maintenance costs and increased life; in his view this was not borne out by results. Capacity increases had been many, but had figures been arrived at on a 'cost *v.* life' basis? Also, what were the relative effects on meters of (a) heavy C.W.G., (b) cyanogen in gas, (c) dehydration, (d) benzole stripping, and (e) oil vaporisation, particularly in reference to diaphragms.

Mr. Armitage said he agreed with Mr. Robinson's opening remarks but all improvements were designed for greater accuracy. As far as cost was concerned he suggested Mr. Robinson compared the value of an old 3 lt. meter with the present D1/200 cu.ft. Carburetted water gas had no great detrimental effect. Cyanogen did affect meters and was most undesirable: fortunately it was not found in large quantities. Dehydration had no effect, unless rapid, largely due to rust deposits drying out and being carried forward. Modern large valves dealt with this problem better than did earlier designs. With benzole stripping the gas might have a tendency to 'grab-back' from diaphragm dressings if the stripping was heavy. Oil vaporisation helped considerably with the rust problem, but must not be used excessively.

Mr. S. Southgate (Bedford) asked if Mr. Armitage was satisfied with plastic valve covers, and who first introduced them, and what were his views of die-cast meters.

Mr. Armitage said that, with the correct type, plastic valves were without doubt completely satisfactory. However they must obviously be constructed in one of the many plastics which were inert in town gas. Microscopic examination showed that wear, with a plastic valve, was in a straight line giving good sealing throughout its life. He was not sure who first introduced plastic valves, but the Germans were certainly using them many years ago. The question of die-cast meters should be viewed in its proper perspective. In actual fact, they were really considering, a die-cast case, and the question arose—'Had tinplate stood the test of time?' He had a 1920 tinplate meter, and would suggest that providing good quality plate was used that meter gave the most definite answer that it would compete favourably with die-cast.

Mr. H. R. Wilks (Watford) asked for views on the direct reading index and whether any standard tests were likely for coin mechanisms.

Mr. Armitage replied that many meter makers considered the direct reading index to be an advance, but it was not well received by the industry, and had to be dropped, despite the fact that pre-war weakness in design had been overcome. He thought that a standard test for the prepayment mechanism was desirable.

Mr. J. Anderton (Great Yarmouth) asked whether they were relying too much on assembly jigs. Valve arms were now hard metal, whereas in the old days these arms were pliable and valve adjustment could be made easier and cut down oscillation. On some meters, leathers were kept in position with a pressed steel band and leathers had been found to be cut or worn where the band went over the rim. Did Mr. Armitage think this might be due to the leathers being on the small side, or was it due to shrinkage? Three 1951 meters fixed were removed after a month's use and were found to be registering from 5.26 to 6.95% fast. Could the author explain why these meters did not hold their test? In regard to butane-air, should meters be changed that were still in guarantee?

Mr. Armitage replied that with modern drawing office control and accuracy of design, most meter parts were now made on assembly jigs, and it became unnecessary to allow adjustment for oscillation. He considered that cut diaphragms were due mainly to inaccurate leather tying. The cause might, however, in rare cases, be the ammonia content of the gas. No reason could be given for early failure of meters. Occasional special cases did arise, but they were usually proved to be outside the control of meter manufacturers. Where change was being made from town gas to butane/air, he would recommend the removal of all meters and the renewal of diaphragms.

Mr. L. C. Coleman (Ipswich) proposed and **Mr. R. W. Hilham** (Colchester) seconded a vote of thanks to **Mr. Armitage.**

STEAM AND POWER IN THE GAS INDUSTRY

Concluded from page 391

under these conditions was equal to that of a diesel engine, and on a quick calculation based on the fact that diesel oil was about 1s. 2½d. per gallon and contained 1.8 therms, this worked out to a cost of 8d. per therm. If it was agreed that a gas engine was of equal efficiency, then, provided the gas could be made at less than 8d. per therm, it was a more economical proposition than using a diesel engine. He thought that this lower price would apply in many works during the summer period, particularly when some surplus base load plant was at work.

Mr. Fisson (Howdon) asked if the steam engine was a good method of driving an exhauster, bearing in mind the well-known fact that this type of drive momentarily stopped and started again in its operational function. He also asked what means of governing were applied on electrically driven exhausters and the degree of power loss experienced by the use of a fluid coupling.

Mr. Clark, referring to Mr. McManus' enquiry, confirmed that he regarded a consumption of 6.8 lb. steam per therm of gas as being easily obtained on a well-designed works. The C.V. of the gas was 530 B.Th.U., and carbonising time 13.2 hours in summer and 12.8 hours in winter. They had experienced no trouble with caustic embrittlement, but a simple test was now applied. A block of steel with a small hole in the centre had the blow-down passed through the hole and was examined after a period for caustic embrittlement.

In reply to Dr. Milner, he thought that over-sized motors were too prevalent in the industry, and that the contractors and users should get together so as to reduce sizes to a minimum. With reference to concrete lining on gas connections on C.W.G. generators, he thought that the differential expansion might make it difficult. In any case, for this particular use the aggregate should be very fine, approximately ¼ in., as the fine aggregate actually resisted abrasion.

He agreed with Mr. Francombe's remarks relating to electric motors. Replying to Mr. Jones, he said there was certainly a case for the use of the gas engine under the conditions specified, but in London they made carburetted water gas all the year round. Consequently it was not an economical proposition. In reply to Mr. Fisson, he said that the use of electricity on exhausters was generally confined to base load units running at constant speed. If variable drive was required it would probably be a variable speed D.C. motor with a mercury arc rectifier. He agreed that a fluid coupling was wasteful in power.